REPORT

ON THE

ADMINISTRATION OF THE DEPARTMENT OF AGRICULTURE AND COMMERCE,

NORTH-WESTERN PROVINCES AND OUDH,

DURING THE YEAR ENDING 31ST MARCH, 1881.

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1881.

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No. $\frac{200G}{II.}$ OF 1881.

FROM

F. N. WRIGHT, ESQ.,

Offg Director, Dept. of Agri. and Commerce, N.-W. P. and Oudh,

To

THE SECRETARY TO GOVERNMENT,

North-Western Provinces and Oudh,

DATED CAWNPORE, THE 11TH APRIL, 1881.

SIR,

I HAVE the honor to submit the Administration Report of this Department for the year ending March 31st, 1881. The report submitted by Mr. Buck last year is nominally for the calendar year 1879, but as he includes operations which were carried on after the close of that year, and the year ending March 31st, 1881, corresponds more closely with my temporary administration of the department, I have adopted the financial year as that to which this report shall relate. I shall for purposes of easy comparison retain the order adopted by Mr. Buck in his last year's report in treating of the several branches of work with which this department is concerned.

The year of report.

2. It is with much diffidence that I lay before you the work of the past year. I am conscious of the disadvantages under which any one must be who officiates in an appointment for which Mr Buck is qualified in so extraordinary a degree—to be, in fact, (*magnis componere parva*) the Hartington to his Gladstone. I can only plead that I have loyally endeavoured to carry on the work on Mr. Buck's lines, and that in anything I have done I have had the interest of the department and the efficiency of the administration at heart. It is impossible but that I should have made mistakes in taking up the duties of an office the connection of which with the old administrative departments is of a novel and peculiar character. But it is with much regret that I lay that office down now when I had, I hoped, obtained a mastery over the multifarious duties attached to it, and, I venture to believe even, the confidence of all officers and private individuals with whom I was brought in contact, so that even if they did not always agree with my proposals, at least they recognised the honesty of the motives which suggested them. The only fault of which I would plead guilty, if indeed it is a fault, is that I have been very jealous for the department which I have temporarily controlled, and anxious to see its efficiency consolidated and concentrated in a greater degree than it seemed to me was the case. It may be the time is not ripe for administrative changes which I have from time to time suggested or advocated; but in making such suggestions I can honestly say I have been actuated by no personal egotism, for I knew that my position was merely that of a temporary occupant.

Difficulties in Director's position.

3. Why then, it might be asked, not leave well alone, and the only answer I have to make is that I have since its establishment been interested in, and I believe I may say, warmly co-operating with the work of the department. That coming in to officiate as its head with the experience gained of its working from the Collector's point of view, it was my hope that some weight would attach to any proposals my

double experience might suggest, and perhaps I felt a greater boldness in putting forward my views as only holding the appointment of Director temporarily, and not being likely to imperil the stability of the department at least by a little plain speaking.

4. Thus far of myself. I now proceed to sketch briefly the work of the past year of the Department of Agriculture and Commerce. Detailed information has been submitted in the special reports relating to each subject, and it will be sufficient to summarise the results obtained.

I.—VILLAGE RECORDS.

Directors connection with patwaris' work

5. Mr. Buck in his report last year clearly pointed out the important share of the work of this department which was connected with the "organization of an effective system of maintaining village records for purposes of revenue and land assessment," or what is known as the kanúngo and patwári branch of the administration. Under the existing Rules, the Director of the Department of Agriculture and Commerce is the Board's Inspector for the purposes of seeing those Rules carried out. It is no use disguising the fact that many Collectors look upon the Rules as unworkable from their excessive detail; that they are popularly supposed to have been elaborated by Mr. Buck himself; and that even now the precise position of the Director, both towards the Board of Revenue, Commissioners, and Collectors, is somewhat undefined.

Drawbacks of the present system.

6. I have no hesitation in placing on record that the present state of affairs is not satisfactory. The Rules, by whomsoever drawn up, are issued under the authority of the Board, and as such command the obedience of the officers whose duty it is to carry them out as implicitly as those for excise, stamps, compensation, enhancement of rents, &c. It is merely the duty of the Director, as Board's Inspector, to see that they are carried out. If the control of an officer in the present position of the Director is irksome to district officers, or, however good in theory, inexpedient in practice, do away with it, remove the irritating cause. But as long as it is the duty of the Director as Board's Inspector to see that the Rules are properly carried out, I venture to think that he is in a false position if he is to hold his hand where he sees cause for blame, because he is likely to weaken his influence in other directions. And yet there can be no doubt that the possible irritation resulting from a strict enforcement of the Rules may weaken the Director's influence in his more legitimate duties connected with Agriculture and Commerce, and it is an anomaly that it should be so. In the capacity of Board's Inspector the Director's duties are executive; in connection with agriculture they are merely those of suggesting and advising; and I do not hesitate to say that there is always the risk of one or the other suffering from this

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Report on Cawnpore Farm		No. $\frac{9}{340}$A, dated 7th July, 1880.
"	Weather and crop rabi ...	No. $\frac{9}{498}$A., dated 3rd August, 1880.
"	Botanical Gardens ...	No. $\frac{9}{486}$A., dated 21st August, 1880.
"	Arboriculture	No $\frac{9}{476}$A., dated 30th August, 1880.
"	Horticultural Gardens ...	No. $\frac{9}{484}$A., dated 1st September, 1880
"	Foreign traffic ...	No. $\frac{9}{23}$C., dated 5th September, 1880.
	Sericulture ..	No. $\frac{9}{530}$A., dated 22nd September, 1880.
"	Railway trade for quarter ending 30th June.	No. $\frac{9}{141}$ A., dated 18th October, 1880.
"	Railway trade ...	No. $\frac{9}{23}$C., dated 28th October, 1880
"	Cotton ...	No. $\frac{9}{650}$A., dated 22nd November, 1880
"	Tobacco ...	No. $\frac{9}{84}$A., dated 19th January, 1881.
"	Railway trade for quarter ending 30th September, 1880. ...	No. $\frac{9}{5}$C, dated 29th January, 1881
"	Court of Wards ...	No. $\frac{9}{129}$A., dated 30th January, 1881.
"	Weather and crop. kharif...	No. $\frac{6}{145}$A., dated 3rd February, 1881.

abnormal union of authority: either the supervision over the patwári and kanúngo work will be less strict, or the force of the suggestions and advice of the Director in the direction of improved agriculture will be weakened. The only argument in favor of the duties of Board's Inspector being retained by the Director of Agriculture and Commerce is that Mr. Buck is personally interested in supervising the efficient performance of duties for many of which he is responsible, and that the continuous supervision of an experienced and personally interested official is the only possible means of securing such efficient performance.

Reasons why Rules not properly carried out.

7. During the past cold season I have marched through a large portion of the North-Western Provinces, examining the work and records of patwáris and kanúngos in the Benares, Agra, and Meerut divisions: my Assistant, Mr. Harrison, performed similar duties for the Allahabad and part of the Rohilkhand division. A very considerable portion, therefore, of the work of this branch of the revenue administration has come under inspection, and I have no hesitation in recording that if district officers are in earnest that the duties perscribed in the Rules shall be efficiently performed, they can be. In some districts not specially favored the work is thoroughly and punctually carried out; that it is not in all is due to other causes than the over-elaboration of the Rules, and one of the principal causes is the still constant employment of a special staff on duties other than those for which they are specially paid and appointed. Take for example the recent census. To maintain a fictitious economy an agency, already fully employed in performing the duties for which it is paid, has this extra duty thrown upon it, with the inevitable result that it afforded an excuse for even a greater laxity of discipline in the preparation of records than the actual amount of work connected with the census justified. Take, again, the work connected with the appropriation of land. Kanúngos are sometimes employed for months consecutively doing this work, to the absolute neglect of their proper duties, for the performance of which no provision is made; and yet it would appear reasonable enough that the work for which the land has to be appropriated should be debited with the cost of the agency necessary for its appropriation, in which case a special staff could be employed or substitutes provided for the kanúngos temporarily deputed on this particular duty. I repeat that if the object with which the Rules were framed is to be obtained, they must be honestly worked and strictly enforced. Any faltering in this matter must result in unpunctual returns, or at best a compilation of vague statistics, worthless and misleading, obtained at a very useless expenditure of a fund specially raised to obtain valuable statistical information—an expenditure that will have again to be repeated at the next revision of settlement, but which it was intended to avoid by the present system. Whether the present staff—whether of patwáris, kanúngos, or district officials—is adequate in numbers and efficiency to effect the object in view is perhaps open to question; but if it is not, and no remedy is applied, I do not hesitate to say that a great deal of useless worry is inflicted, and the resulting statistics are not worth the paper they are written on. But as a general rule I am prepared to say that the existing staff, if properly kept to the work, is sufficient for a full and complete performance of all the duties in the existing Rules. Districts differ, parganas differ, individual patwáris' circles differ. I have seen this cold weather statistics which I should not hesitate to accept as a settlement officer at once. I have seen work of which I could not possibly say as much. I trust that the careful examination I have this year made of the work or records of the subordinate revenue staff may have some useful result, and the new Rules, framed by the committee of which I was a member, and to which it is not necessary here further to refer, if sanctioned by Government, will remove all possible excuse for the non-performance of the important duties connected with the compilation of statistics. I have submitted full reports to the Board of Revenue of the character of the work as found by me and Mr. Harrison on inspection, and as due notice will probably be taken of them in regular order, there is no necessity for me to repeat here what I have reported in detail to the authority under which I was acting.

8. But I would in passing mention one point connected with any detailed inspection of patwáris and kanúngos' work which appears to me prejudicial to the efficient working of a Department of Agriculture: a conscientious discharge of this duty necessitates a slow and laborious tour extending over several months of the year at that time when agricultural business is most active, and both for their own sake and for the object contemplated on their appointment the officers of the department should be free to travel rapidly about, consulting, advising, visiting shows, &c., their headquarters being those of the Government of these provinces for facility of reference and despatch of business. Both duties can possibly be performed together, but not thoroughly and effectively.

District inspected.

9. The districts which were visited by Mr. Harrison and myself were as follows: by Mr. Harrison—Fatehpur, Cawnpore, Hamírpur, Bánda, Jalaun, Farukhabad, Bareilly, and Budaun; by myself—Meerut, Bulandshahr, Aligarh, Agra, Mainpuri, Etáwah, Etah, Azamgarh, Gorakhpur, and Basti. So that out of the 31 districts in which the new patwáris and kanúngos' records have been inaugurated, the work in more than half was inspected—a result not before obtained. Mr. Harrison inspected 27 tahsils, comprising 78 kanúngos and 2,548 patwaris' work; while my portion included 36 tahsíls, comprising 146 kanúngos and 3,978 patwáris' work.

Improvement perceptible in records.

10. Both I and Mr. Harrison noticed great improvement in the record system since the new Rules have been brought into force. In some districts—notably in Aligarh, Agra, Cawnpore, Budaun, and Fatehpur—the papers have attained such a degree of accuracy that I, as an ex-settlement officer, could without any hesitation pronounce them to be a sufficiently reliable basis for purposes of assessment. In these districts the Collectors have taken special interest in giving effect to the Rules promulgated by the Board and Government, and have to some extent thus secured the real object for which such a large establishment has been kept up at the expense of the landlords and tenants. That the work *is* within the power of the staff appointed for it the results in these districts furnish very strong proof.

11. On the whole, however, general improvement is perceptible everywhere, and both the patwáris and kanúngos are beginning to awake from the apathetic torpor which became habitual to them from long irresponsibility. In most of the districts the village records have now been earnestly taken up, and the compilation of the pargana registers have been commenced by the registrar-kanúngos, and in many districts completed up to date.

Examination results.

12. The examination to test the qualification of the kanúngo staff was continued during the year, one being held in each division. The following are the results of the examinations held during the past year:—

	Total number examined.	Number finally passed.	Number conditionally passed.	Number totally failed.
Sadr kanúngos	8	3	5	...
Registrars	104	52	27	25
Supervisors	222	125	78	19
Candidates	203	82	20	101
Total ...	537	262	130	145

The total result of examination up to date stands as follows:—

	Total number.	Number passed finally	Number not passed finally.
Sadr kanúngos	30	21	9
Registrar-kanúngos	165	89	76
Supervisor-kanúngos	408	239	169
Total ...	603	349	254

II.—Traffic Registration.

13. This important branch of the department duties has been throughout the year, as heretofore, in charge of Mr. Fuller, Assistant Director, and during his absence on furlough of Mr. Harrison. Mr. Fuller's thorough grasp of the details connected with the compilation of statistics has been recognized by Government in their review of his report on the trade of these provinces, and the work could not be in better hands.

Administration of Commerce Department.

14. Mr. Buck in last year's report gave a sketch of the general scope of the departmental operations in this direction. It may be subdivided into—

General scope of traffic registration.

I.—Registration of traffic crossing the frontiers of Tibet and Nipal.

II.—Registration of traffic passing along the roads in a selected portion of these provinces.

III.—Registration of railway-borne traffic.

15. Registration under the first head is maintained under the orders of the Government of India, who bear a moiety of the charges. The machinery for the registration is a chain of posts, the same in number and in position as before maintained, along the frontier at points where they are crossed by roads or navigable rivers. These posts are necessarily at some distance from any habitations, and effective supervision is therefore almost impossible. They have all been inspected by one of the departmental Inspectors, and every endeavour is made to secure accuracy in the returns. It is evident, however, that it is impossible to look for more than approximate accuracy, and the frontier registration will always remain the most unsatisfactory portion of the trade registration of the department.

Foreign traffic.

16. Registration of traffic on provincial roads is carried on with the definite object of assisting the Public Works Department with statistics bearing on the questions:—(i) of the maintenance or abandonment of some of the less used metalled roads of the province; (ii) of the extension of the system of light railways. It was arranged that the traffic carried along metalled roads should be registered piecemeal, and the Benares, Allahabad, and Jhánsi divisions were taken in hand during the past year. The year for which these posts were established does not end till 1st May, 1881; it is therefore premature to speak definitely of the results obtained. But great care has been taken to ensure the accuracy of the returns; all the native clerks employed were selected by my Assistant, Mr. Fuller, after passing an examination and receiving instruction in the duties they were to perform. Each post, moreover, was inspected four times during the year.

Road traffic.

17. Registration of railway-borne traffic was maintained in the system originated by Mr. Buck. The returns now come in with greater punctuality and contain fewer errors than was the case during the first two years of operations. The returns were always received quarterly, but have hitherto only been utilized in compiling an annual return, which was of little value from its late appearance. During the past year these quarterly returns, in a somewhat abbreviated form and prefaced with a short explanatory note, have been published separately (as received) in the *Gazette*. Efforts are being made to ensure their appearance within, at the outside, ten weeks of the end of the quarter to which they refer.

Railway traffic.

18. Two important changes have been made in the system of registration during the past year:—*Firstly*, net weight has been shown instead of gross weight—that is, the net weight of the article minus that of its packing. The railway audit officers can only give gross weights; but a table has been drawn up in this office, after most careful enquiry, showing the proportion which packing bears to the total weight of the consignment: and the audit officers now make deductions from the gross weight in accordance with it. The table has, with a few trifling modifications, been adopted by the Government of the Panjab and Lower Bengal.

Net weight registered.

European piece-goods separately recorded.

19. The second change is the separate registration of European and Indian piece-goods on the East Indian Railway. This important addition to our information has only been obtained since the railway became the property of Government; the Company having regularly declined to make the distinction, on the ground that increased establishment would be necessitated by it.*

III.—Construction of wells.

State wells.

20. Mr. Buck, in his report last year, explained in detail the connection of this department with the experimental construction of (so-called) State wells. The wells which I proposed to build in the district of Cawnpore have been completed and the result reported to and reviewed by Government. The wells which were being constructed under Mr. Alexander, Settlement Officer of Moradabad, are not yet complete; but the whole case has been so thoroughly dealt with in the correspondence connected with it that there appears no necessity for further discussing a question which is not yet ripe for a decision.

Wells in Awa estate.

21. Connected with the attempted solution of the problem how to obtain a cheap and efficient well, Mr. Wilson, Assistant Engineer attached to this department, has been constructing some wells in a portion of the Awa estate, where from the nature of the sandy substrata no wells made after the native method ever tapped the permanent spring. The wells were sunk five feet in diameter, of segmental bricks laid dry, and the intention was that if the clay stratum were reached the permanent spring would be tapped; if no clay were reached plugs would be put into the wells, which would obtain their supply from percolation between the bricks, or if by this means an insufficient supply of water was obtained, borings would be made to the permanent spring. Two wells were made, costing Rs. 240 per well; but the cost was high owing to the necessity of making experiments to find out whether the native *jhams* or Bull's dredger was most effective, and the charges for establishment were disproportionate to the number of wells constructed. Mr. Wilson believes that wells can be made for Rs. 180, but that it is safer to assume Rs. 250 for each well all round, as the depth of the clay stratum is uncertain.

22. I took the opportunity of meeting the Commissioner of the Agra division at Awa to obtain his and Mr. Crooke's consent for Mr. Wilson to further prosecute his experiments by the construction of nine more wells at once and a larger number at his discretion, the total sum placed at his disposal for the year being Rs. 5,000.

IV.—Reh Experiments and Glass-making.

Reh operations under this Department.

23. *Reh.*—During the past year Mr. Wilson has been engaged in carrying on the scientific and agricultural experiments which were allotted to this department in the programme, based on the recommendations of the committee which met at Aligarh in 1878. It will give a clearer idea of what has been done if I give Mr. Wilson's report *in extenso* in an appendix (D.) I have myself inspected the arboricultural experiments near Awa. So far they have had but little success: but the patience and thoroughness with which Mr. Wilson is carrying out his investigation are sufficient guarantee that success, if possible, will reward us in our endeavours to find some means for removing the excess of salt in the wide *usar* plains of these provinces. What can be done in Utah by the Mormons should at least be possible in India. That portion of the programme which was allotted to the Irrigation Branch of the Public Works Department has made no progress, owing to the fact (I quote from a letter received) that "the arrangements entered into by the committee were made before the sweeping reductions of the Public Works establishment came into force, and that since these reductions the Irrigation Department has with difficulty carried out its own proper work in constructing and

* The very imperfect performance by the department of what would appear to be one of its principal duties, the collection of agricultural statistics, cannot fail to be a matter of regret. It only prepares a brief *résumé* of the results of each harvest, and is able to give no statistics of outturn or area. At the same time it has nothing to do with the weekly reports of the agricultural condition of the country submitted by district officers. The new Patwaris' Rules will provide for the former, and the latter might pass through this office.

maintaining the canal works in these provinces, and has not had a man to spare for the *reh* enquiry." The experiments, however, made by this department cannot be considered conclusive till complemented by the information for which we must look to the Irrigation Department.

24. *Glass-making.*—Mr. Buck in last year's report described the preliminary operations undertaken for utilizing the large amount of available material lying waste in the *reh* of the *usar* plains of the Awa estate, and I take this opportunity of putting on record what little progress has since been made.

Mode of glass-making in Europe

25. The following description of glass manufacture at Venice is abridged from the monograph published by the committee of the Vienna Exhibition referred to by Mr. Buck last year. The process may be divided into eight parts:—

(i) The melted glass is drawn into tubes about 120 metres in length.

(ii) These long tubes are divided into lengths of about one metre.

(iii) The different sizes are sorted.

(iv) The tubes are then cut into minute pieces.

(v) The pieces are put on a sieve to get rid of the fragments.

(vi) They are then put into a pan containing a mixture of sand and fine ashes and stirred about till the holes of the small pieces of tube are filled up.

(vii) They are then put into an iron cylinder with some sand and coal-dust, and the cylinder is made to revolve over a fire until beads are rounded.

(viii) The sand and ashes are then cleared out of the holes and the beads are completed.

Preliminary operations in Awa.

26. Mr. Wilson procured the services of four men from Purdilnagar, district Aligarh, in which village beads were made about twelve years ago. These men know something of the work, and had some of the tools used in the manufacture. They made a furnace at Awa in a building kindly lent for the purpose by Mr. Crooke. The process adopted by them was similar in principle to that used at Venice, but their tools were very rough, and the beads made were very irregular. It is probably owing to the inferior quality of their beads compared with those imported from Italy that the Purdilnagar men have allowed the manufacture to drop.

27. Another furnace was constructed in the same building by Karim Khan, a glass-blower of Lucknow. This man was instructed by Mr. Wilson in the method of manufacture adopted at Venice, and some tools were made from the description in the monograph previously alluded to; but as no sketches were given, the tools were very imperfect, and the beads made were little, if any, better than those made by the Purdilnagar men.

Tools procured from Europe.

28. Mr. Wilson visited Venice in October last, when on leave. I had authorized him to purchase tools, and had procured for him a letter of introduction from the Government of India to Signor de Zuccato, the British Vice-Consul at Venice. Signor de Zuccato did all that he could to assist Mr. Wilson in seeing the bead-makers at work, and has procured a complete set of tools—a matter of no small difficulty owing to the jealousy of the Venetian manufacturers. The tools have recently arrived in this country, and arrangements are being made to start a furnace similar to those used in Europe. The furnaces made by the natives of this country bring the glass to a consistency fit for blowing, but do not give sufficient heat to thoroughly melt it. In order to purify the glass it must be made quite fluid, as then the infusible impurities rise to the surface and can be skimmed off, and the glass obtained is free from bubbles. There is no reason, if the native glass-blowers can be taught the mechanical details of the art of glass-making as practised at Venice, that as good beads should not be made at Awa as are imported from abroad.

V.—Eradication of kans.

Importation of steam plough.

29. During the past year, the importation of a steam plough has been successfully carried out for the purpose of bringing again under cultivation the wide tracts of

otherwise good soil hitherto rendered valueless by the dense growth of the weed *káns*. The apparatus consisted of two 16 H. P. engines with an 8-furrow plough, a 9-tyne cultivator, harrows, and (on trial) a double-furrow plough especially invented for dealing with land in the foul condition in which the *káns*-infested soil of Bánda is. The tackle was landed in Calcutta and brought up to Allahabad just before the commencement of the rainy season. It was then too late to transport it to Bánda, but a trial was made of it in Allahabad, where its usefulness was at once apparent. Arrangements were then made to transport the plough to Bánda early in the cold season that it might benefit from whatever moisture there remained in the soil ; for, as is well known, the *már* soil (in which *káns* is chiefly found) quickly hardens, and is broken by countless cracks and fissures. The pressure of possible scarcity, however, prevented Mr. List, C.E., under whose supervision the machinery has been imported and set up, from being at liberty to superintend the transport, and though the Collector of Bánda, Mr. McConaghey, had everything ready by November, it was not till the 6th January that a start was made for the scene of operations. Fatehpur was reached in five days, and after a necessary halt for three days a fresh start was made for the river Jumna, which was reached on the morning of the 17th. Here jetties and boats were all ready, and one engine was immediately conveyed without a hitch across the river, and the other the following morning. On the 20th January the engines reached the ground at 10 A. M., and in half an hour were in position and at work with the turning cultivator, having travelled 120 miles and crossed a large unbridged river in 12 days without a difficulty or hitch, not a bolt having slacked or a pin dropped out on the journey. Since that time the plough and cultivator have been at work steadily. Accidents have, of course, happened, but have been of such a nature only as to call attention to weak points and have been at once remedied. Difficulties about bad water have been removed by the substitution of tank water for well water, which being impregnated with lime caused the boilers to prime. Ample store of *babul* wood had been collected by Mr McConaghey and was found to answer better even than coal. Native drivers have been entertained which will give a saving in the cost of working, as well as sparing the European superintendents from exposure to the fierce heat of the Bánda climate in May and June.

Arrival of steam plough in Banda.

Prospects of the steam plough.

30. A liberal estimate made by Mr. McConaghey places the total annual expenditure at Rs. 5,000; and it is anticipated that 125 acres per month for eight months of the year will be worked by the special plough, or 200 acres with the cultivator, giving a cost per acre of Rs. 5 with the special plough and Rs. 3-2-0 with the cultivator, exclusive of depreciation, wear and tear, and interest on capital, which will raise the cost to about Rs. 10 per acre for the special plough and Rs. 6 for the cultivator. Supposing, therefore, that the special plough is used for half time and the cultivator for half time, the area brought under cultivation will be $125 \times 4 + 200 \times 4 = 1{,}300$, or at the rate of about Rs. 8 per acre, for which the land will readily let the first year, bringing an average rate of Rs. 4 per acre subsequently, and this for land which is now bringing in a nominal rent of 5 annas per acre. Thus a difficult experiment has been brought to a most successful issue through the exertions of Mr. McConaghey and Mr. List, C.E. In Allahabad, during transit and on the field of operations, the big engines and irresistible force of the ploughs have excited the greatest astonishment and admiration of crowds of natives who have thronged to see the novelty, and have been tempted to ascribe superhuman agency to what they could not otherwise account for. But more practical results have been obtained ; applications have been received from zamindars owning good *már* land overrun with *káns*, who agree to give half the produce of the land for two years for one ploughing with the cultivator (which both here and at Allahabad seems most approved by the Indian ryot, being more in accordance with his own ideas of cultivation). As the produce of such land should be 14 maunds of grain for the first year and 10 maunds for the second, it should have an income of 12 maunds against an expenditure of Rs. 6.

VI.—Arboriculture.

31. Roadside arboriculture has made considerable progress during last year. The systematic method of planting and maintenance described in my special report on arboriculture for 1879-80 was followed in all the districts. Out of about 2,500 miles of public road in North-Western Provinces and Oudh about 1,500 miles are every year under arboricultural operations, involving the maintenance of about 500,000 trees. Upwards of 200,000 plants are every year planted out on roads from the nurseries, most of which are fruit or fodder producing. Without special reasons no other trees are allowed to be planted. These plants are raised in 110 nurseries scattered over all the province. Groves are also planted here and there, and instructions have been given for their establishment on an extensive scale in the Jhánsi division, which is most deficient in trees. Private persons have also been encouraged to plant trees on roadsides with the privilege of taking the fruit and dead wood, and in some districts they have come forward to do so with alacrity. The fixed Government grant for arboriculture is Rs. 38,900; but last year an additional grant was made, bringing up the total to a little over Rs. 41,000. The grant has now further been supplemented by the receipts from sale of fruits and timber obtained by thinning out existing avenues, which for last year amounted to about Rs. 20,000. The total sum at the disposal of this department for arboricultural purposes is for next year (1881-82) nearly Rs. 59,000.

Trees planted last year

Sum available for expenditure.

32. Besides avenues on public roads, opportunity is taken to interest private persons in horticultural operations by supplying them with seeds and plants from public gardens free of or at a nominal cost, by giving instructions for planting, and by explaining to them the great benefit which trees confer on a country from the food and fodder they yield, from the wood which frees cowdung for manure, and from their power to attract and retain moisture. This subject was prominently placed before the Talukdars of Oudh assembled at the Lucknow Exhibition. Arboricultural operations have also been taken in hand in the Court of Wards of the North-Western Provinces, with which this department is connected in matters of agricultural improvement.

Planting by private persons.

VII.—Public Gardens.

33. The department has also administrative control over the Saháranpur Botanical Garden and the Lucknow Horticultural Gardens, executive details being left to the Superintendents in charge. I have elsewhere mentioned the great value its connection with these two important institutions is to the department: but I believe also that they benefit by their connection with the department, and it might, in my opinion, be extended to other institutions of a similar class: *e g.*, the Táj gardens at Agra and the Khusru gardens at Allahabad. In the case of these last two the executive control as now would be in the hands of the Collector, but continuity of supervision and probably a more systematic development of general usefulness would be obtained by placing all public gardens under the control of a department specially qualified to advise and assist. It might even be advisable to classify the Superintendents of such gardens departmentally, thereby securing a flow of promotion and opening inducements to good men to come out in the hopes of future preferment. Under the present system the gardener at Saháranpur, for instance, has no opportunity of rising to a better position; there is the risk that he might be led to leave his situation for a better, depriving the Government of the benefit of his acquired experience.

Desirability of placing public gardens under the department.

34. A beginning has been made in the past year in establishing plantations for the experimental cultivation of exotics at Saháranpur, Agra, Lucknow, and Allahabad; but the work has as yet made little progress beyond the renting and preparation of the land required for the purpose. The Government grant for the object was Rs. 300 for Saháranpur, Rs. 400 for Agra, Rs. 400 for Lucknow, and Rs. 400 for Allahabad; total Rs 1,500.

Exotic plantations commenced.

VIII.—Sericulture.

Operations by Mr. Lepper.

35. The principal feature of the year's operations was the connection of Mr. C. H. Lepper, agent for Messrs. Lister and Co. of Bradford, with the sericultural operations. They were conducted entirely under his supervision, though the financial responsibility of Government remained unimpaired. He distributed seed to selected rearers, made advances to them and bought their cocoons. He was given the use of the Government sheds and the mulberry trees on roads and canals. He encouraged the further development of the industry, *i. e.*, of cottage rearing, by giving first class prizes and medals to successful rearers.

Transfer of the farm to Messrs Lister and Co.

36. Negotiations were carried on during the year, having for their object an entire transfer of sericultural operations in the Dún to the firm of Messrs. Lister and Co. Some little delay was occasioned by the natural desire of Mr. Lister, the head of the firm, to see for himself in what kind of undertaking he was embarking, and what was the real value of the concessions Government were prepared to make with the object of encouraging the firm establishment of the industry in the locality which experiment had shown to be *primâ facie* suitable for it in every way. Mr. Lister arrived in India in January, and in February last the Officiating Commissioner of the Meerut division, Mr. Elliott Colvin, the Superintendent of the Dún, Mr. Church, and I myself, met Messrs. Lister and Lepper at Dehra and drew up final proposals for the favorable consideration of Government, which have, so far as the Government of the North-Western Provinces is concerned, been accepted. The concession recommended for sanction is a grant of land in the Eastern Dún on such terms as shall secure that a *bonâ-fide* endeavour shall be made to establish and extend the silk-rearing industry in that locality. Messrs. Lister and Co. are a firm with practically unlimited command of capital, and they are prepared to take up a strong position at the outset, and to invest such considerable sums in bringing land under cultivation, in securing an adequate water-supply, in importing labor and in general improvements, that, humanely speaking, there can be no question of success. Messrs. Lister and Co. are prepared to take every ounce of silk produced; indeed, the amount that will be forthcoming, even from the liberal grant of land proposed, will be insufficient to supply their demands for raw material. The Government of the North-Western Provinces may be congratulated on transferring to competent and willing hands the further development of an industry which it has, though at some small annual loss, fostered from its birth and proved to contain all the elements of future success.

Mr Ross's services to sericulture.

37. In connection with this subject it is only just to notice the connection Mr. Ross, formerly Superintendent of the Dún, has had with sericulture. To his intelligence and care sericulture in the Dún owes whatever measure of success it may have obtained. In his report for 1879-80, as the last opportunity he would have of doing so, he has embodied the results of the experience of many years' supervision of the operations, and, as Government in their review of his report remark, "if silk becomes a prominent industry in the Dún, there can be no doubt it will be entirely due to his exertions."

Mulberry plantations in the hills

38. The question of the establishment of mulberry plantations in the hills for the purpose of cottage-rearing has not gone beyond the stage of discussion. Mr. Lepper is urgent in insisting that no breeding of the silkworm by private rearers should be allowed; they must get the eggs from head-quarters and take in the cocoons immediately on their production. The establishment of plantations at intervals and at considerable distances from the Dún would necessitate the establishment of subsidiary distributing and collecting agencies, and for the purpose of destroying the worm in the cocoons, subsidiary *etouffoirs*. On the other hand the Forest Department have expressed their willingness to assist by devoting certain fixed areas in selected localities this object, and planting and superintending the growth of the young mulberry, till large enough to allow of the plantations being leased out to private rearers. The scheme, however, requires an initial outlay of some Rs. 7,000 spread, it is true, over three or four years, but bringing in no return for that period;

and some guarantee is required on the part of Messrs. Lister and Co. that they will take all the silk produced and co-operate with Government by the establishment of the subsidiary agencies: at present they are so fully engaged with the larger project connected with the grant of land in the Dún that they are not prepared to work out this scheme in detail, and it therefore for the present is in abeyance.

IX.—Tobacco.

Connection of N.-W. P. Government with tobacco manufacture.

39. A report was submitted by me on the tobacco operations at Gházipur and Pusa, under Messrs Begg, Dunlop and Co., for the past year in January last. The operations at both localities are so interdependent that it is impossible to report on the one, *i. e.*, Gházipur, which lies in these provinces, without mentioning the other, Pusa, which is in the province of Bengal. Pusa is now the headquarters of the operations; but as long as the Government of the North-Western Provinces afford substantial encouragement to their prosecution, by giving up land on liberal terms for the cultivation of tobacco, it is necessary for this department to watch the progress of operations, protecting the interests of Government, as well as securing the full development of the industry by seeing that the proper use is made of the means provided for it.

Local demand for good tobacco.

Export of cured tobacco to Europe.

40. The most notable fact brought out by last year's operations was that there is a sufficient market in India to take all the tobacco of every kind that the firm can turn out. No doubt the original intention of the encouragement given to the enterprise was the opening of a demand for Indian tobacco in the home markets: and the prices obtainable in England for Indian-cured tobacco were good enough to justify the hopes that a considerable trade would be gradually opened out. In 1877-78, 3½*d.* per ℔. was an average (but remunerative) price obtained for a tobacco not so well cured as subsequent experience has enabled the firm to turn out. In 1879-80 the high price of 5½ *d* per ℔. was obtained for the best tobacco, and offers were made for further shipments; but, as I have said, the interest of the firm, so far as operations have gone, are best secured by first satisfying the local market. The extension of operations so as to supply the demand for export as well as for local consumption will be certain if gradual: as the establishment is more thoroughly trained and the industry takes firmer root, a wider field will be essayed, with the certainty of success.

The tobacco farm establishment

41. The firm now employs on this business a Superintendent (Mr. Wishart); a Manager (Mr. Williamson, the expert first entertained by the firm); two assistants; Mr. Caine, in independent charge of the Gházipur farm; and an agent who travels over India to introduce the manufactured tobacco. The native hands employed in the business number about 400. Cultivators round the farms grow tobacco for the factory, land and seed being given them on condition of their making over a third of the produce and selling the remaining two-thirds if the firm chooses to take them.

The Gházipur receipts.

42. I may here mention that the receipts from the Gházipur farm, amounting to Rs. 5,230, after payment of compensation to the zamindars now, were formerly at the disposal of this department only after realization of the rents. An annual grant of a sum equal to the previous year's net receipts has now been sanctioned for the use of this department in conducting experiments.

X.—Kumaun orchards.

43. On the present condition of the Kumaun apple orchards and potato gardens Sir H. Ramsay, Commissioner of Kumaun, in whose charge they are, has most kindly sent me the following note:—"The Muktesar orchard has made considerable progress during the past year. One consignment of apple seeds succeeded admirably; the other which came soon after completely failed, only a few seeds germinating. The strongest seedlings were transplanted for grafting to the ground which had the previous year been used for potatoes, and already five thousand of these seedlings have been grafted. The wood used in grafting is taken from known good trees, such as Ribston, King Pippin, Cox's Orange Pippin, King of Pippins, and other good eating apples. Others are being grafted. A quantity of potatoes (162 maunds) was

sent to the plains for distribution, and the large potato gardens in the vicinity of Naini Tal have been supplied with good seed. Some has been given to natives and planters in different parts of the district. New ground has been prepared for potatoes this year, and will be planted out with apple trees next cold weather. About 1,000 sweet chestnut trees are in good condition, but a great many seeds failed. The wild pear is being grafted, and all the young trees promise to do well." The result of the operations in establishing the eating apple on common cultivation in Kumaun will be that, as Sir H. Ramsay says, "apples will soon be sold at the railway stations like oranges."

44. A complaint was made, however, by private growers that the competition in the Naini Tal market of the fruit grown at the Government nurseries at Ránikhet was unfair to them. Considering the degree to which they are indebted to us for grafts, &c., the complaint seemed unreasonable, and as long as there was a demand for apples in Naini Tal, I could see no justice in maintaining an artificial prize by the exclusion of competition. As an experiment with the object of opening up other markets, a small consignment of apples was sent to Cawnpore and were sold at 6 to 8 for the rupee, their value in Naini Tal being one anna apiece. I therefore suggested that the surplus produce of the Ránikhet nurseries, after satisfying the demand from the neighbouring barracks, should be consigned to the larger stations which had easy communication with the hills, where a market might readily be forthcoming for a delicacy not obtainable otherwise at that time of the year, and for a class of fruit superior to that brought down in the winter by the Cabul merchants. These suggestions obtained the approval of Government, and, if carried out, will effect the very object for which Mr. Buck advocated the establishment of apple orchards in Kumaun. The necessary expenditure on these orchards is met from the Gházipur receipts.

XI.—Improvement of cattle.

Establishment of cattle farm in the Dun.

45. The attention of this department has for some years been directed towards the adoption of some measures for improving the breed of agricultural cattle in these provinces. At one time proposals were before Government for the establishment of a cattle farm in the Dún, but the scheme was at last temporarily abandoned.

46. Subsequently Major-General Angelo, R.A., who has been officiating as Superintendent of the Government Cattle Farm at Hissar, submitted proposals with a similar object, and negotiations are still in progress as to the terms on which some encouragement could be fairly given him; I fear, however, that they will come to nothing. On the one hand is the urgent necessity for cattle farm somewhere and the undoubtedly great and valuable experience possessed by General Angelo on this special subject. On the other hand is the fact that General Angelo is not possessed of any capital and is necessarily compelled to ask Government for everything—land, funds to start with, and continual encouragement for the future. The only alternative to conceding all General Angelo asks is to place him in charge of a Government farm, which, however, it is not at present, as I have said above, considered desirable to establish.

The difficulty of procuring bulls.

47. And yet, if any practical good is to be done in the direction of improving the breeds of agricultural cattle, this department must have a reserve on which it can draw for good bulls and cows for breeding purposes. The difficulty of getting even a few bulls from Hissar is very great owing to the preferential claim of the Panjab Government to all cattle not required for commissariat purposes. Mr. Harrison, Officiating Assistant in this department, did what he could this last winter to get some good bulls of the famous Kenwaria breed from Bundelkhand, but only succeeded in getting eight now, with the promise of twelve more; and yet applications have been received from numerous quarters for good bulls of a sturdy moderate-sized class, fit for the plough, both on purchase outright or on hire at Rs. 16 per annum. Sooner or later some scheme for meeting the unquestioned demand for good cattle for breeding puposes will have to be worked out, and, as far as our information at present goes, nothing will be sufficient short of a cattle farm established by or directly under the support of Government.*

* A grant of Rs. 2,000 has been sanctioned for the purchase of bulls in the form of an imprest the cost of the bulls and transit being recovered from purchasers.

48. Some good may result from maintaining small cattle-breeding establishments in the headquarters of the larger estates under the management of the Court of Wards. One of these has been commenced at Awa by Mr. Crooke, the enterprising Manager, to some extent in accordance with the advice and with the assistance of this department. He has four bulls (three of which were supplied by this department)—one a half English, one a Deccani, one a Mysore, and the fourth a fine country-bred animal. Two Hánsi cows and eleven cows from the famous cattle-breeding tracts near Ral, in the Muttra district, have been purchased; a large steading or byre has been built, good fodder (the secret of success) is plentiful, and Mr. Crooke hopes in a couple of years to have a large number of bulls available for distribution in outlying villages. The people already bring their cows to be served by the Awa bulls, taking their choice of sire as they wish to breed for the plough or for milk only. The influence of the introduction of a superior breed of cattle into any locality in this manner cannot fail to spread.

Breeding establishment in Court of Wards' estates.

49. The only other means of encouraging private breeders to rear a superior class of cattle is that of giving prizes at the various local fairs for the particular breeds which are found to be most useful for agricultural work; but as I propose to refer to agricultural fairs in a subsequent para., I will not pursue the question further in this place. But as in some degree indicating the direction this department would work, I give as an appendix (B.) a note drawn up by Mr. Buck on the Batesar Fair of 1879, for comparison with which I give an extract from the report on the fair of 1880 (appendix C.), showing the result so far of Mr. Buck's suggestions. The process of improvement of the agricultural breeds of cattle by this means will be a long one, but without doubt effected.

Prizes at cattle shows.

50. Mr. Buck procured a ram and two ewes from Australia, which are located in the hills, under the charge of Mr. Craw of the Dunagiri plantation. He reports them as doing well. But for a general improvement of the breed of sheep more systematic arrangements must be made for breeding a good class of animal. Twenty rams have been obtained from the Hissar Farm and distributed, and it remains to be seen how far this breeding of a better wool-giver than the country breed can be popularised.

Australian sheep

XII.—Experimental Farms.

51. The farm at Cawnpore has been throughout the year in charge of the Assistant Director, assisted by Mr. Crawley. I cannot think this the most satisfactory arrangement, though it may be the best immediately possible. The duties of Assistant Director necessarily takes him away from the farm during no inconsiderable portion of the year, during which the experimental operations are left with very imperfect supervision. Mr. Buck in last year's report noticed the difficulty of obtaining efficient superintendence for the Cawnpore Farm, yet without it a most important experiment may be vitiated, because irrigation is not given or the harvesting not commenced on the right day, or proper protection against peculation and loss by birds, &c., is not taken; or, in a word, because orders are not properly carried out. It is a mere question of money. This department cannot be administrative and executive at the same time. Without the assistance of a thoroughly trained professional agriculturist, it is one-handed: its advice or suggestions run the risk of being set aside as those of an amateur, its experiments of being condemned as inconclusive or wanting in exactness. Failing such assistance there could be no better arangement than retaining Mr. Fuller in charge of the experimental farm. There is probably no officer in the provinces who, by early training and subsequently acquired experience, is better fitted for his position. But I still think that the present arrangement is not fair to him or to the department. To be *totus teres*, the department must have professional and scientific help. This principle has been recognized by the Famine Commission, and it only remains to give effect to their recommendations by finding sufficient funds to afford a salary which shall attract competent men to this country. A sum of Rs. 4,500 was formerly allotted to the pay of a Superintendent for the Cawnpore Experimental Farm. There was more-

Efficient Superintendent for farm not procurable.

over, a Superintendent of a model farm at Allahabad, also drawing Rs 4,500. The land attached to the Government farm at Allahabad has been restored to the Municipality, and the services of the Superintendent have been retained as a gardener (for which post Mr. Phillips is thoroughly fitted) in charge of the gardens attached to various institutions in Allahabad. I venture to submit that however necessary the entertainment of a gardener is for the metropolis of the North-Western Provinces, yet that the funds devoted to his salary would be spent more in accordance with the spirit of their original intention in meeting the salary of a Superintendent for the Cawnpore Farm, possessing a scientific and practical knowledge of agriculture. Madras has its farm at Sydapet managed by professional agriculturists ; but their efficiency and their influence on the agriculture of the country is impaired, if not entirely destroyed, by the want of a Department of Agriculture to point the direction in which their efforts of improvement should be directed and to secure the co-operation of Government officials in their efforts. The North-Western Provinces have their department, but it is, in my opinion, weakened by the absence of coadjutors possessed of a scientific and practical knowledge of agriculture. In botany it has the inestimatable advantage of being able to utilize the scientific knowledge of Mr. Duthie, the Superintendent of the Sahâranpur Gardens ; in horticulture Mr. Ridley, Superintendent of the Lucknow Gardens, and Mr. Gollan, head gardener, Sahâranpur, can and do afford most valuable assistance. But botany and horticulture are but accessories to the great science of agriculture, of which the department is the representative in these provinces. I agree with what Mr. Buck says in last year's report, that "an agricultural expert of unquestionable ability and undoubted authority is required for India :" but for all that I am strongly of opinion that in each province the local department of agriculture should be strengthened by the addition of a practical agriculturist (*e.g.*, a graduate of Cirencester College) : and that the present arrangement, except as a means of training for Mr. Fuller or for some other young civilian who may follow him, is unsatisfactory. I am certain that much adverse criticism of the department's operations would be silenced by such a step, and that the department itself would have much greater confidence than it now has in inculcating principles or offering advice on agriculture.

An agricultural school a desideratum.

52. I would even go further and say that we cannot expect the science of agriculture to spread over the length and breadth of the land whilst its exponents are limited to two hard-worked officials whose administrative duties fully occupy their time. It is necessary to educate others who can take to the management of their own or others' estates, and to the cultivation of their own land or the superintendence of experimental farms in every part of the province, the grand truths of scientific agriculture which they should be taught at Cawnpore. At Sydapet there is a class of agricultural students who (I gather from a list recently sent me), once they have passed the course, readily obtain employment as agricultural instructors or managers of estates. A similar institution is wanted for these provinces, but is impossible under existing arrangements. I have made an attempt to utilize the experimental farm for educational purposes by entertaining a few Eurasian apprentices, whose number will be increased as funds are available. They have to work with their own hands in every operation of the farm, they plough, sow, reap, thresh, &c., and are taught that manual labor is as honorable or more so than quill-driving in an office. Unfortunately there have been no means of giving them any instruction in class : Mr. Fuller is naturally too much occupied with his numerous duties. Mr. Crawley is not competent to teach. They have been encouraged to avail themselves of the departmental library, but a proper instructor is a crying want. It might even be possible to give apprentices properly grounded at Cawnpore scholarships to Cirencester, such as the Government of Bengal has established, and so introduce into India a body of trained agriculturists, to whom the conditions of Indian agriculture were familiar and who would apply the scientific theories they learned in England to the practical working of an Indian estate. Already there is a demand for an agricultural instructor in Rája Jagat Singh's Institution, but a competent man is not forthcoming ; and I have been

obliged to return the same answer to Mr. Bernard, Chief Commissioner of British Burma, who made a similar request.* *Apropos* to this subject is the want of a simple practical manual of agriculture for the use of schools and agricultural classes; I have been often asked for one. Mr Fuller's Primer has not met the approval of the Department of Public Instruction, and it is therefore the duty of the department to modify it so as to suit the intelligence of those for whom it is intended.

53. Mr. Buck in his last year's report commented on the operation of the Cawnpore Farm during the rabi season of 1879-80, and I need therefore only call attention to the results of the experiments conducted by Mr. Fuller in the kharif season of 1880. They were chiefly directed towards proving the relative value of different manures, but the unfavorable nature of the season vitiated the accuracy of the experiments in this direction. As a set-off however, convincing proof was obtained of the great benefit resulting from deep cultivation, whether by inversion of the soil or stirring the subsoil, to all plants that are deep feeders, such as cotton and pulses. The millets and other cereal grasses which are surface feeders not only do not immediately benefit by deep cultivation, but, perhaps, suffer from the rawness of the newly-turned-up soil. This fault may be remedied by ploughing the land immediately after the rabi harvest is over; the soil exposed to the full force of the hot wind and sun of May and June ripens, so to speak, and some of Mr. Fuller's experiments show considerably increased outturn on land so treated compared with that only ploughed at the usual time.

Benefits of deep-ploughing.

54. The superiority, or at least equal value, of indigenous varieties of cotton (the Hinganghat and Kulpahar) as compared with imported kinds, such as the New Orleans and the upland Georgian, were clearly brought out by Mr. Fuller's experiments. By a careful selection of seed and thorough cultivation, as good an outturn of as useful a staple can be obtained with the country cotton as with the foreign varieties, the seed of which has to be imported at considerable trouble and expense

Superiority of indigenous cotton

55. The Cawnpore Mills use short-stapled cotton almost exclusively, or with but a small admixture of the finer staples. For this there are two reasons: (1) their machinery is only adapted for turning out the lower counts of yarn, and it would not pay to alter it so as to turn out finer goods, in which it would have to compete with Manchester; (2) the principal trade of the mills is in yarn, which finds its way by numberless distributing channels to the country weaver, who makes only the coarser cloths, and often uses the (to him) fine yarns of the mills for his warp, spinning his own coarse cotton for the weft. For these reasons, too, the Bamieh cotton is as yet entirely unsuited to these provinces.

Long-stapled cotton has no market

56. An interesting experiment on the relative amount of dry fodder obtainable from various fodder plants now more or less known shows that the country jowar holds its own against reana (*Euchlæna luxurians*), sorghum, red and black, and guinea grass. Reana, indeed, from the high cultivation it demands and its comparatively small outturn of fodder may be considered as quite useless for these provinces. Sorghum gives a large quantity of fodder and possesses high saccharine qualities. As regards the latter it may be largely grown for sugar, as it occupies the ground for a considerably shorter period and requires less irrigation than sugarcane; but as regards fodder sorghum will do admirably where a large number of cattle is kept, that is in municipalities and stud farms; it will never supplant jowar with the ordinary cultivator, who looks for a grain crop as well as fodder and cannot devote even a small portion of his limited holding to a fodder crop alone

Fodder experiments.

Value of sorghum.

XIII.—Workshops.

57. The Workshop continues to send out adapted ploughs, the "Kaisar" pattern having now a very wide popularity, which the substitution of a fixed beam for the

Popularity of the Kaisar plough.

*A survey school for kanúngos is also a great desideratum. The Raja of Etah has proposed the establishment of one in connection with the High School founded by his father, Raja Dilsukh Rae; but a headquarters school, which it should be compulsory on every kanungo to attend for some short term, has long been an idea of mine.

rope will certainly enhance. The Indian ryot is not yet educated up to using a swing plough, which is difficult to adjust and quite a novelty to himself and his cattle, and it is necessary to yield to his prejudices as far as possible without abandoning the principle for which we are contending As he will not take the "Kaisar" at least in large numbers without a beam, it is better to meet him half way and give him the beam In time he will come to ask for a still higher class of plough, such as was shown at the Lucknow Exhibition, the manufacture of Messrs. Howard and Co. If he sees the advantage of using it, there is no reason why he should not pay Rs 10, or even Rs. 15, for a good plough, when he is buying the Bihia sugar-mill in large numbers for Rs. 80.

The improved winnower

58. A cheap and efficient winnnower has been turned out in the Workshop which attracted much attention at Lucknow, and will probably obtain a large demand if strongly made and easily repaired.

Windmill for raising water.

59. A Kewani windmill has been imported from America at the suggestion of Mr. Bernard, then Secretary to the Government of India, in the Home, Revenue, and Agricultural Department. It is premature as yet to decide on the use that can be made of such a power. Experiments will be made to test its efficiency against the ordinary methods of raising water already in vogue in this country.

60. One of the wants of the country is a threshing machine. English manufacturers have not yet grasped the idea of the poverty of the classes who must be their only customers.. They expect to sell machines which will cost three or four thousand rupees. Ignorant of the conditions of the country, physically and economically, they cannot understand why the large landed proprietors do not buy steam ploughs, threshing machines, &c. Endeavours will be made to modify the one in use on the farm so as to bring it within the reach of landowners cultivating fifty or a hundred acres of *sir*. Possibly the "horse power," a revolving platform, may also be modified to allow of its being used for bullock power.

Pioneering duties of the Agricultural Department.

61. The duty of this department is clearly that of a pioneer: thoroughly acquainted with the wants of the Indian cultivator, it must by experiments ascertain what implements used in the more scientific methods of the agriculture of the West it can adapt to his ideas and his purse. When experiment has done its work, further action should be left to private enterprize. What this can achieve is shown by the success of the Bihia sugar-mill, now sold by thousands in the sugar-producing districts. This department has taken every opportunity of encouraging the use of this excellent machine; but the patentees, by establishing agencies in the districts where the demand is likely to be greatest, and where the purchaser can have a broken mill repaired or exchanged, have, in a short space of time, popularised their invention to an extent that we can only hope the improved plough, winnower, and pump will gradually reach.*

Success of the Bihia sugar-mill.

XIV—Court of Wards' Estates.

Court of Wards' estates as model farms.

62. This department cannot hope to influence native agriculture directly; it must employ some form of agency for the purpose of bringing home to the cultivating classes of the country the results of its experiments or enquiries in the matter of improved staples, implements, or stocks. One agency already exists in the form of estates under the management of the Court of Wards; the other is to be found in the establishment of local Agricultural Institutions, of which as yet only one at Bijnor has been completely established, though another is being formed at Jaunpur.

Estates connected with the department.

63. The three estates under the Court of Wards which have been (under the authority of the Board of Revenue) in regular communication with this department are the—

Awa estate in the Etah and other districts.
Rawatpur estate in the Cawnpore district.
Karam Ali's estate in the Meerut district.

* I do not think, however, that the Department of Agriculture should endeavour to supply the demand for implements, even those adopted by its own officials. Its establishment and resources are inadequate to meet any large demand, and without trained supervision there is always the fear that articles of inferior workmanship may be sent out. It would be better to utilize Roorkee.

In addition to the above, Mr. Wyer, Assistant Collector in charge of the Dubari estate in the Azamgarh district, has constantly corresponded with me and has afforded cordial co-operation in the use of improved implements and new staples.

Result of last year's operations.

64. I have recently submitted a report to the Board of Revenue showing in detail what the officers in charge of the abovenamed estates have done towards the introduction of an improved system of agriculture. Little has been accomplished in the Karam Ali estate, owing beyond question to the fact that it is not under the management of a special officer, as is the case with Awa and Rawatpur, but of the Collector, who is naturally unable to devote time for close supervision of agricultural details.

65. The personal interest taken by Messrs. Crooke, Harrison, and Wyer, has been productive of the most excellent results. It is unnecessary for me to recapitulate in detail all that these officers have effected—of the constant use of the English plough; of the selection of the highest qualities of indigenous staples and the experimental introduction of new ones; of magnificent fields of cotton and mangold wurzel, of winter maize; of imported bulls; of improved sanitation and communications—and, in a word, of everything that goes to differentiate an estate managed by an intelligent English official from the thousands of estates still in the hands of apathetic and ignorant native proprietors. Awa, Rawatpur, and Dubari are our true model farms, and this influence is already being felt beyond the immediate limit of the essate. Cultivators press for the new kinds of seed they see so successful, try the ploughs, bring their cows to be served by a better class of bulls than heretofore, and so on. But the influence which is so beneficial must be continuously maintained. There is no spontaneous movement amongst the masses towards agricultural improvement: there probably will not be for many years. Meanwhile, the teaching of this department must be brought to bear on the classes whom they are intended to benefit through the agency of selected officials, and, if possible, these should be retained for this special duty for some time. A break in continuity often undoes all the good that has been achieved, or at any rate postpones progress for a time. Mr. Crooke, I am glad to think, remains at Awa for some time yet. I regret to learn that Mr. Harrison has left the Cawnpore district, where he did such excellent work in popularising improved methods of agriculture in Rawatpur.

Secret of agricultural success in estates.

66. The Awa estate is now practically independent of this department under the intelligent management of Mr. Crooke, who has adopted and loyally carried out the programme drawn up by Mr. Buck. Another might be brought in its place into similar communication with this department, and the first steps in improved agriculture be taken in a fresh field. But I do not hesitate to say that success entirely depends on the personal interest taken in the work by the officer in charge. This department can only advise and assist, and a considerable portion of its duties consists of demi-official correspondence with officers in charge of Court of Wards' estates, as well as others interested in the improvement of the agriculture of the North-Western Provinces and Oudh.

Result of experiments decisive in estates.

67. The extent of the action to be taken in estates under the management of the Court of Wards in the above direction is a *vexata quæstio*. Some say that nothing new should be undertaken where there is the least risk of a loss; but as it is necessary to plunge into the water to learn to swim, we may fairly ask that new methods of agriculture, or new seeds which we have shown by experiment to have *primâ facie* every reasonable chance of success, shall be subjected to the wider test of their applicability to Northern India by being made the subject of experiment upon a broader scale and more in accordance with the ordinary conditions of agriculture in Court of Wards' estates situated in various localities in the North-Western Provinces. The climate of Meerut, Rohilkhand, the Lower Doab, Bundelkhand, the eastern districts, and the sub-Himalayan tracts differs widely: what will succeed in one will perhaps be a failure in another; and it is necessary that everything new should be tested under every variety of physical and economic conditions possible. If an estate is rich, it

cannot devote a portion of its surplus wealth to a better purpose than in bringing openly before the native cultivator the inestimable benefit of an improved method of agriculture. Far better this than to accumulate large sums for the heir to squander as soon as he attains his majority.

XV.—Co-operation of native land-owners.

Influence of the department among land-owners.

68. During the past year considerable progress has been made in consolidating and extending the particular agency for spreading far and wide the influence of this department, to which Mr. Buck refers in the concluding paras. of his last year's report—I mean the friendship and co-operation of native land-owners. Not only in these provinces have we many regular correspondents, who, as Mr. Buck says, "make experimental farms of their estates," coming to us for advice and assistance, but from other parts of India letters frequently are received containing similar requests.

Kaisar plough outside N.-W. P.

69. Specimens of the Kaisar plough have been ordered from and despatched to the places named in the margin, showing, if any need of proof remained, the want of such a department all over India. Foremost amongst our fellow-workers in this province are Pandit Ajudhya Prasad of Shahjahánpur, whose report I printed last year, and who took a leading position as an agriculturist at the Lucknow Exhibition; and Raja Jagat Singh, whose single-minded liberality has given Bijnor what no other district has, though I hope every district soon will have an Agricultural Institution with an experimental farm attached. To show what can be done by such institutions, I annex the report of the Secretary (Pandit Sri Lal) on the experiments conducted in the kharif harvest.

Ajmir, Akola, Amraoti, Bangalore, Bhagalpur, Bilaspur, Bombay. Chittagong, Dera Ghazi Khan, Dholpur, Hyderabad, Jabalpur, Jhallawar (Rajputana), Indor, Lahore, Narsinghpur, Poona, Prome, Purniah, Raipur, Sagar, Sydapet, Shahpur, Sholapur, Tanjore, Udaipur, Umergaon, and Yeotmahal in Central Provinces.

District agricultural associations required.

70. My own opinion is that it will be better to concentrate in such institutions the energies of those native gentlemen who are willing to assist the department in introducing agricultural improvements, rather than that they should fritter away their opportunities in unsystematic, and probably therefore unsuccessful, experiments in their own *sir*; such action is in itself good, but it should be subordinate to a scheme of district Agricultural Associations working hand in hand with this department. Such associations will naturally look about for some means of bringing the results of their labors before the general public. These will be found in the district agricultural shows, of which Bulandshahr so far takes the leading place. It will not be necessary, in my opinion, to hold an agricultural show in every district every year. It will be sufficient to have one show for each division, held in each district in the division in its turn. By this means the influence of the improvement in agriculture, originated and fostered by this department and carried into practical working by the agricultural associations, would affect a very wide area, and we might hope that lasting benefit would gradually spread all over the North-Western Provinces.

Position of the Department with respect to Fairs.

71. But I venture to submit that, if real good is to be done, the connection of the Agricultural Department with such fairs must be placed on a satisfactory footing. If the department has any *raison d'être* at all, it is surely where the comparative merits of agricultural produce, stock and implements are to be adjudged, and where new ideas can be collected or diffused, as must necessarily be the case where zamindars and ryots are gathered together primarily, perhaps, for the sake of a spectacle, but with their respective faculties awakened and with a ready willingness to be taught. By this department alone can the principles on which prizes should be given be properly formulated, and under its superintendence alone, from what I have seen, will a proper system of adjudication be obtained. My experience is that the prizes are now awarded in the most unsatisfactory and perfunctory manner; the award carries no weight and reads no lesson. Nothing is farther from my ideas than to supplant the district officer from his rightful position as head of these district gatherings; but no one man is competent to be a judge in all that an agricultural show contemplates, and I have little doubt he would welcome the

assistance of the officers of this department in dealing with the awarding of prizes for agricultural stock, implements, and produce, as he does that of the Superintendent of Horse-breeding Operations in adjudging the prizes to the horses exhibited. I am certain that the native zamindar will be more ready to listen to the teachings of the department if he sees it has a recognised position at such exhibitions. What is now only a taste would become a duty. The judges would naturally be selected from among the members of the district agricultural associations, and it would gradually be esteemed a high honor to belong to one of these, with the prospect of eventually belonging to a Provincial Association, the members of which would collectively and individually do useful and valuable work in the cause of agricultural improvements.

72. The culminating point of all the divisional agricultural shows should be the provincial one, held at Lucknow or Cawnpore. By holding it at Lucknow we undoubtedly secure the cordial co-operation of the Talukdars of Oudh. It is an open question, however, whether other portions of the United Provinces should not share in the undoubted benefit which has resulted from the exhibition recently held. With regard to this a separate report will shortly be submitted to Government. It is only necessary here to record that the connection of this department was confined to giving advice and such assistance as drawing up notes for consideration at the daily conferences and superintending the adjudication of prizes for agricultural stock, implements, and produce. As the outcome of the work of this department, improved ploughs, pumps, and winnowers were exhibited and were highly appreciated, large orders being given for similar articles by enterprising landlords. Several native gentlemen (our correspondents) and Court of Wards' estates contributed exhibits of highclass staples, wheat, cotton, sugar, &c., and a remarkably excellent collection was exhibited of the several artistic manufactures* of the North-Western Provinces which this department fosters, and for which it has stimulated a demand by establishing an emporium at Allahabad at Messrs. Lawrie and Staten's Hotel, where travellers can and do make large purchases.

*Moradabad, inlaid ware.
Benares, brass ware.
Nagina, carved ebony work.
Mainpur, wire-set wood-work.
Agra, black wood-work
Sahâranpur, carved white wood-work.
Muttra, colored boxes.
Jaunpur, Kashmir colored plates.
Azamgarh, Aligarh and Amroha pottery.
Agra, soapstone and marble works.
Bânda, agate.
Azamgarh, silk.
Cawnpore-made cloths of Ludhiana pattens.

Department to encourage manufactures.

73. It is, I would submit, the province of this department also to foster every industry other than artistic which is likely to utilise and develope the resources of this country. Acting on this principle, I have ventured to bring to your notice the establishment of a soap manufactory at Meerut, and to solicit the patronage of the Government of India in the Military Department to an undertaking which must for some time depend on such help for success, but which in its aim, as utilising country produce and adding another industry for the surplus labor of the urban population, deserves every encouragment.

74. Promoters of such schemes as soap manufactories, oil-mills, paper-mills, &c., naturally look to this department for advice and support; and I do not think it could be utilised for a better purpose than by being placed in such a position as to give that advice and support authoritatively, and being the channel through which such persons should approach Government with applications for assistance.

75. Similarly, the Director should be (as indeed he already is in practice) the recognised referee for this province on all questions of patents connected with agricultural implements.

CONCLUDING REMARKS.

Department's position on general administration of the country.

76. In conclusion, I must apologize for having ventured to do more than submit a mere statement of what the Department of Agriculture and Commerce has done during the past year, and for having criticised its work generally in the past and offered suggestions for increasing its efficiency for the future. I have been only tempted to do so from the peculiarly close connection I have always had with the department, having officiated as Director in 1878 and again during the past year, and I have always

been one of its warmest supporters when acting as a district officer. From my experience in both capacities I do not think the department is sufficiently utilised in the administration. While its energies are wasted in the laborious drudgery of supervising the patwári and kanúngo's work, it has little or no connection with other important objects (such as the collection of agricultural statistics which) more legitimately claim its controlling care and advice. I have already submitted certain suggestions on this point in my No. 21G., dated 20th February, 1881, and it would be as unbecoming as unnecessary to repeat what I have there ventured to say. I have always endeavoured, " whatever my hand found to do, to do it with my might, " and this must be my excuse for whatever, in my temporary occupation of this difficult post, has failed to give satisfaction."

77. It but remains for me to place on record my thanks to Messrs. Fuller and Harrison, who have so ably assisted me during the past year. Mr. Fuller's merits are sufficiently well known to Government. Mr. Harrison was new to the work of the department, but carried out the particular duties assigned to him with praiseworthy energy and thoroughness. Mr. Wilson has also rendered me much valuable assistance.

78. The following papers are appended to this report:—

Appendix A.—Report of Raja Jagat Singh on the kharíf operations conducted on his estate at Tajpur in the Bijnor district.

Appendix B.—Note by Mr. Buck on Batesar Fair of 1879.

Appendix C.—Report on Batesar Fair.

Appendix D.—Mr. Wilson's report on Reh experiments.

I have the honor to be,

SIR,

Your most obedient servant,

F. N. WRIGHT,

Offg. Director, Department of Agriculture and Commerce, N.-W. P. and Oudh.

APPENDIX A.

RAJA JAGAT SINGH'S REPORT ON KHARIF OPERATIONS.

No. 1, dated Tajpur, the 4th February, 1881.

From—RAJA JAGAT SINGHA *of Tajpur, district Bijnor,*

To—F. N. WRIGHT, ESQ., C.S., *Offg. Dir. of Agri. and Commerce, N.-W. P. and Oudh, Cawnpore.*

SIR,—I have the honor to submit my report on the results of the agricultural experiments conducted at Tajpur during the kharif season of 1880, the seeds used in all cases being those forwarded to me with your office circular No. 6A., dated the 9th of June, 1880. This collection of seeds reached me on the 16th June, and I immediately selected a piece of ground which was best fitted for sowing and where irrigation was easily obtainable. The land was liberally manured and carefully worked up with the native plough, the Kaisar plough of Cawnpore not having arrived by that time. The rains in 1880 began earlier than usual, and it was not till the 16th of July that all the seeds had been sown except "lucerne," which was sown as late as the beginning of October and has germinated freely. I regret that the kharif season under report has been a very bad one. The early commencement of rains was followed by a violent break, and the consequent drought and heavy westerly winds told severely upon the sowings. I had to irrigate them from a well and a large tank situated close to the fields. The young plants were well watered and kept green until the middle of September, when the heaviest and unprecedented falls of rain occurred throughout the whole district, damaging the kharif crops. All the fields under experiment at Tajpur were flooded, and the maize in particular suffered to a great extent. The result of each experiment is noticed below. It will be seen that, with the exception of the several kinds of maize and cotton, whose failure is mainly due to the excessive rains, the experiments have, on the whole, been a fair success ; and taking into consideration the adverse character of the season, coupled with the fact that this was the first year in which experiments were initiated, the results are what might be expected under the circumstances :—

No. I. Sorgho.—Twenty seers of this seed were sown in 40 bighas, at the rate of half a seer per *kham* bigha. It germinated well, was twice weeded and irrigated, and though the plant came up as high as 9 feet, the drought greatly hindered its full growth. The outturn in grain is one maund and in fodder 10 maunds per *kham* bigha. So far as the yield of grain is concerned, sorgho cannot be said to hold its own against the Indian *chari*, though in respect of its outturn in fodder it favorably compares with the same. Sorgho is best suited to the soil and climate of this district. I have kept 16 maunds of seed for the ensuing kharif.

No. II. Reana.—Two seers were sown in four bighas and grew well ; it has been once cut and again irrigated. The outturn of fodder may be estimated at 10 maunds per *khám* bigha. This crop is especially suited for places close to wells, and can be profitably cultivated in this district, as it thrives at Tajpur. It is an excellent fodder for horses, and they feed on it very greedily. Its seed (1 maund 11 seers) has been collected, and will be sown in the current year.

No. III. (a) Egyptian cotton, called Bamieh.—From two seers of seed sent, one seer was picked out as good for sowing, the other half being eaten into by

worms which made their way into the parcel. This one seer was sown in two *kham* bighas, and, although irrigated, has been a total failure, not a single plant having appeared on the ground.

(*b*) *American cotton* (*New Orleans*).—Half a seer of seed was put into 15 *khám* biswas, was weeded thrice and irrigated. The outturn is 13 seers.

(*c*) *American cotton* (*upland Georgian*).—Half a seer was sown in 14 biswas *khám*, weeded thrice and irrigated in August. The outturn is 15 seers.

No. IV. (*a*) *American maize* (*golden dent*).—Three-quarters of a seer was sown in 10 biswas, and though the field was twice weeded and irrigated, the produce has been very inconsiderable, *viz.*, 2 seers only. This failure may be attributed to the September floods.

(*b*) *Adam's extra* (*early corn*).—Three-quarters of a seer was sown in 10 biswas, weeded and irrigated ; but the heavy floods destroyed the crop, the water standing in the fields for several days. The outturn is 2½ seers.

(*c*) *Burst's white* (*flint corn*).—Three-quarters of a seer received was sown in 10 biswas ; outturn 9 chittacks.

(*d*) *Yellow Canada corn.*—Three-quarters of a seer was sown in 10 biswas ; outturn 6 chittacks.

(*e*) *Tascarora corn.*—Three-quarters of a seer was sown in 10 biswas ; all destroyed by the floods.

No. V. (*a*) *Excellent maize* (*from Jaunpur*).—Twenty seers of seed received were sown in 20 bighas. The outturn is only 2 maunds and 20 seers. The flood seriously affected the crop, and thus the yield is below what might have been obtained under favorable circumstances.

(*b*) *Excellent maize* (*from Jaunpur*).—Ten seers were sown in 10 bighas. Outturn of a bigha, 12 seers. The rest succumbed to floods.

No. VI. Ground-nut.—A field of 6 biswas was sown with 2 seers of seed. It germinated well, and although it was a mistake to sow it in a hard soil, whilst it is suited for sandy places, the outturn has, on the whole, been satisfactory, *viz.*, 11 seers. Ground-nut, or *múng phali* as the natives call it, is a very good pulse, fitted for cultivation in this district. Its green leaves form an excellent fodder for cattle, and the people also eat the nut very fondly. It is generally admired as a useful introduction into the Bijnor district.

No. VII. Inga pulcis.—Two seers of this *babúl* were sown and the plants, when a foot high, were set up as a fence round a garden.

No. VIII. Lucerne.—Two seers of seed were sown in the beginning of October ; it grows well here and is an admirable fodder for horses.

In addition to the above seeds supplied by the Department of Agriculture and Commerce I also received a seer of a kind of cotton seed, through a friend, from Mir Shahamat Ali Khan Bahadur, C.S.I., Political Agent in Central India. I do not know the exact name of that particular kind of cotton, but I suppose it is known as *Narma*. Half the seed was sown in 14 biswas, and the outturn is 21 seers and 12 chittacks. The color very much resembles that of tobacco, though I am not certain whether the cotton keeps this original color when washed by the *dhobi*. I herewith send, as a sample, two seers of this cotton.

In conclusion, I have to offer my cordial thanks to you for the interest you have taken in me and the material assistance your department has rendered in the shape of seed and advice.

APPENDIX B.

Mr. Buck's Note on Batesar Fair.

There were five kinds of bullocks in fairly considerable numbers at the fair, according to the classification which I made in my note-book, which does not differ eventually from that on Dr. Willmott's list :—

(1) Those brought from Mairwara chiefly by banjaras.

(2) Those brought from the other side of the river Chambal, called the Bhind and Chambal cattle.

(3) Cattle from east districts of the Doab.

(4) Muttra or Gokul cattle.

(5) High-class cattle from Hariana, Nagor, &c.

(1) *Banjara cattle.*—These are, as a rule, very small and mean-looking. The banjaras say that the Doab and Oudh agriculturists cannot afford a larger or more expensive breed. The cattle they bring are said to come from the country intermediate between Jodhpur and Nagor, in both of which large, fine cattle are bred. It is well known that banjaras came over in great numbers to the Doab about March and April, bringing Mairwara cattle which they have bought from large dealers. They generally camp (gipsy fashion) in open spaces along river banks or in scrub and grass jungles, while their cattle graze in the neighbourhood without injury to cultivation, since the spring crops are then all cut. These months are also convenient to the agricultural classes who require to buy at that time in readiness for the ploughing season.

The same set of banjaras do not always go to the same locality, but sometimes to one and sometimes to another. There is almost always a very good feeling between them and the zamindars and cultivators of the villages which they frequent, and mutual credit is freely given. They sometimes resort to a summary method of reclaiming their dues from a debtor, and I have heard of a whole gang of them laying siege to and surrounding the house of a cultivator who had failed to pay the price of cattle for which he had received a year's credit, and while the rest of the villagers looked on without making or wishing to make any interference.

The number of banjaras at the fair does not at all represent the proportions which they bear to the whole number of cattle-suppliers to the North-Western Provinces; they deal, as a rule, more directly with the zamindars, and not through the medium fairs.

(2) *Bhind cattle.*—The Bhind sellers breed and bring their own cattle. Most of those who were at the fair were Bhaduria Thakurs, the head of whose clan resides at Nayagaon, only 14 miles from Batesar, though the cattle-sellers themselves come from the other side of the river Chambal.

On making enquiries from them about the bulls from which they breed, I was told that whenever a Thakur of any position or rank dies, his relations procure the best young bull which they can afford to buy, of some well-known breed, and bring it to the village. The Bhind cattle are a strong, lusty, but rather coarse set of animals, with, as a rule, rather long, erect, but curved horns. They were apparently well fitted for agricultural work, and many of the best of them were brought for sugar-mill work in the Bijnor district.

(3). *East district cattle.*—These are termed by the natives Purabis, *i. e.*, "Eastern." Some of these were brought by the owners, who buy them in some cases from banjaras or at fairs, but in others have bred them in North-Western Provinces villages. The greater number appear to come from the Jumna ravine tracts, where there is an excess of grazing land, but some from the Doab (Mainpuri and Cawnpore). They are

brought also by beparis (cattle-dealers) who have bought them from zamindars and cultivators, and also by dealers at local fairs. A great number of the Doab cattle are very young and small. The purchasers are villagers of moderate means, who take them back to their villages and keep them there until old and strong enough for work. On the whole, this was the poorest class of cattle at the fair.

(4) *The fourth class* (*Gokul*) are bred in the celebrated tract of country in which Krishna "sported with the cowherdesses." These are fine cattle, of much strength and good breeding, but expensive. Some pains appear to be taken to select and procure good sires from Hariana and other Rajputana districts for the Gokul breeds. Animals this class were not very numerous at the fair.

(5) *The fifth class* are what may be ranged under the general term of Rajputana cattle, which include cattle of the Hariana, Sind, and Nagor, or other western breeds, Hariana predominating. These are the most highly-bred cattle and the most expensive.

There are two-well known fairs, one in the Hariana district in September and one at Hissar in October. Beparis (dealers) buy there and bring over to Batesar. There are also weekly fairs held at Kosi, in the east of the Muttra district, which naturally draw their supply from the Rajputana direction, and at which dealers also purchase for Batesar. A considerable portion of these higher-class cattle are good and expensive for ordinary agricultural work, and it is somewhat difficult to decide how far they can be classed under the head of agricultural.

The most celebrated breed is the Nagor, which stand 56 and 57 inches in height. Sires of this breed are much sought after. The Hariana with Nagor sires are very good and well suited for draught, and trot fast in a native bullock carriage or *baheli*. The half-breds are called doglas. The Harianas bear much the same relation to the coarser agricultural cattle that thorough-bred horses in England do to farm animals. The coarser agricultural catte were destined for—

(1) The upper Rohilkhand districts, to which they were taken by dealers in large numbers. The strong Bhind and Jumna cattle predominated, and were required, it was said, for sugar-mills as well as ploughing.

(2) The Meerut division as above, but in less quantities.

(3) The central Doab district, for which some were bought by cultivators, but most by dealers, usually small cattle. The question which has to be decided in connection with prize-giving at the fairs is in what direction prizes can be expected to influence the production of better cattle. In general terms, it may be assumed that prizes for high-class cattle bred and bought outside the province will have no effect whatever in inducing the improvement of agricultural cattle in the North-Western Provinces, and the only object in giving prizes for such animals is to bring forward to our own knowledge the best types to be found at the fair. It can hardly be supposed that the offer of a prize of Rs. 10 or Rs. 20 will induce a dealer to bring better foreign cattle to the fair, and much less that it will have any effect on breeding in Rajputana. The method of classification employed this year served well enough for a preliminary trial, which is all that the operations of the present year are meant to be; but there is no doubt that many modifications must be made in future.

(*a*) It appears, therefore, to be a question how far we ought to give prizes for cattle of the high-bred large class. There is, indeed, little difficulty in bringing such cattle forward for prizes or in adjudging the awards, since they are prominently so much superior in quality to all the rest. But rich zamindars and mahajans give good prices for them, and I don't think they want much extra encouragement; and I should be inclined to advocate keeping prizes for this class, at least within confined limits and in much smaller proportion to those awarded for agricultural cattle.

(*b*) In the next place, prizes being given, as they rightly are, for pairs and not single animals, precise age interferes with the awards, and some difference of age ought to be allowed. It was found, indeed, necessary on this occasion to relax strictness in the matter of age, or the best fairs would not have obtained prizes.

(*c*) In the third place, there was a decided tendency to exclude from selection for prize competition the coarser agricultural cattle, and this under every class named. As a fact, the finer Hariana breeds were brought forward and obtained nearly all the prizes. But the former are bought by the bulk of the agricultural classes for their wells and ploughs in preference to the highly-bred animals. When the cattle chosen at the preliminary selection were brought up for final competition there was hardly one out of the Bhind herds forthcoming, and there would have been none of the banjara cattle present at the prize distribution had not special orders been given to the head of the banjaras at the fair to bring forward half-a-dozen selected pairs in the possession of his tribesmen, for the best of which one or two consolation prizes were awarded.

If prizes are to be given at all for fair cattle, I am strongly of opinion that more encouragement should be given to the best types of the coarser classes, and that strength, bone, well-knit frames, and cheapness should be the chief considerations.

I advocate also that a height should be fixed so as to exclude the higher class breeds altogether from competition for agricultural prizes. Below this there should be at least two heights arranged for the smaller classes, one of which would bring in cattle used for wells, manure carts and ploughs, and the other small cattle for light ploughing work. Whatever changes may eventually be made in the agricultural system of these provinces, thousands of small cattle will continue to be bought for years to come, and any encouragement possible should be given to the production of the best and strongest of the small breeds.

In determining the points which constitute a good pair of working bullocks, the assistance of natives is valuable. On this occasion the judging committee were much helped by a native gentleman—Resaldar of the Gwalior Cavalry—who came to buy for the Maharaja (Scindia), and by one of the Hindu Stud Overseers ; but both were, in my opinion, too much inclined to exclude all but the best western breeds.

I think that the native judges should, in future years, be more numerous, and should include at least two or three agricultural zamindars, who really know farm business. They will help much to make right conclusions as to the best beast for farm work. English cattle in England and native cattle in India must be judged on such very different principles, on account of the very different purposes for which they are used, that the points entitling to a prize must be very different. For the reason last stated, I believe that to a European a knowledge of horses is a better guide than a knowledge of English cattle in determining the merits of agricultural bullocks. Dr. Willmott and Mr. Butt, who were the best judges of the points in a horse at the fair, were therefore the best judges (among the European officers) of the working power of cattle for draught purposes, and without their assistance it would have been difficult to award prizes. A committee should, in my opinion, always include a European who is thoroughly experienced in judging horses, and his knowledge combined with that of the zamindars will enable freely just judgments to be made.

I advocate, then, that the principles on which next year's prize list should be formed, should be that special prizes should be given—

A. Under the head Agricultural Local (1) for the best cattle brought—

(*a*) From Bhind or Chambal tracts and bred there.

(*b*) From the Jumna ravines or adjacent villages.

[These are bred so close to North-Western Provinces as to admit of inclusion in local breeds.]

(Sd.) E. C. BUCK,

Director, Dept. of Agri. and Com., N.-W. P. and Oudh.

APPENDIX C.

REPORT ON BATESAR FAIR

Batesar, the 22nd November, 1880.

From—KUNWAR NAUNIHAL SINGH, *Tahsildar of Pinahat,*

To—*Collector and Magistrate, Agra.*

SIR,—I beg to submit a report on horned cattle present at the Batesar Fair held on the 16th November, 1880. By the census there were 45,996 horned cattle present at the fair, as detailed below :—

Bullocks.		*Buffaloes.*		Cows.	Cow buffalo.	Total.
Laden.	Unladen.	Laden.	Unladen.			
2,989	40,321	1,213	436	580	457	45,996

Now I compare the number with that of the last three years :—

In 1877	17,564
„ 1878	20,062
„ 1879	25,738
„ 1880	45,996

We have plenty of cattle this year. The scarcity of rain, and its consequent scarcity of fodder, induced the cultivating breeders to part with their cattle, and hence the increase in the number of cattle brought to sale at the fair.

2. To find out the number of cattle actually brought for sale, I excluded laden ones, and thus we get the number of 41,794 to be the number of cattle actually brought for sale. The optional registered sales amounted to the number of 8,893, which brought in a revenue of Rs. 1,111-10-0 to Government. Though the registration of sold cattle is quite optional with the purchaser, still it includes by far the larger number of cattle actually sold. Even supposing half as many more sales as registered, I think the market dull, and the dullness was for the most part owing to the scarcity of fodder this year. We have introduced registration since 1878.

We got { Rs. 210-6-0 in 1878
„ 610-9-0 in 1879, and
„ 1,111-10-0 in 1880 }

3. Purchases were extensively made by the people of Rohilkhand and the upper districts of the Meerut division, mostly for the purpose of working sugar-mills, the season of which being at hand.

4. We see three kinds of cattle predominating at the fair, *viz.* :—

(1) Chambalpari—far more numerous than all the rest.

(2) Kosi breed (the same which Dr. Willmott styles Marwari and Mr. Buck calls Muttra and Gokul breed), Kosi being the principal emporium for cattle at the borders of Meerut and Muttra districts.

(3) Purbi cattle. Except Chambalpari, both Kosi and Purbi are cross-breeds (Hariana or Mewat bull and Desi cow.)

We met with very few banjaras in the fair They like to sell their cattle more in their own and usual way than to resort to fairs, they being too frugal to feed their cattle with purchased fodder here at a high price. They are also averse to deprive their cultivator friends, whose waste land is freely grazed upon by their cattle, of the opportunity of purchasing cattle on credit system at their own door, to their great convenience.

(1) *Chambalpari* oxen are for the most part brought in by cultivators themselves, who, having excess land for pasturage, are in a position to breed cattle for themselves. By the time when this fair takes place they have ploughed and sown their fields, and as they have no occasion for them in the winter and hot season (there being no irrigation work for rabi crop), they are very willing to part with them, specially when their rainy crop fails. Bhind cattle are good pack-animals, and the difference between them and that of Chambalpari is so little as not to be worth consideration for practical purposes. Bhind cattle, however, can easily be distinguished from that of Chambalpari by the smallness of their size and generally reddish color.

(2) *Kosi breed* is brought in by beparis (dealers), who are in general Mewatis by caste.

Purbi cattle.—These are generally brought by different people from Doab, Mainpuri and Cawnpore districts predominating.

Buffal es and cow buffaloes are so few at the fair as not to need any special remark. Cow buffaloes are valuable for their milk only, while they are not directly useful for purely agricultural purposes to any considerable extent.

5. Here I think it necessary to state that bullocks are put to two uses : (1) carting, and (2) other agricultural business. Again, the agricultural business is to be divided in two sections : (*a*) drawing charas from wells, and (*b*) ploughing, &c., of fields.

6. A pair of oxen about fifty inches in height, stout-bodied, with broad chest and thick and strong neck, is fit for draught purposes, while a bullock under 50 inches with a capability of endurance during a season of scarcity, cheap and strong, is a suitable animal for a cultivator. Chambalpari bullocks are admittedly most suitable ones for ordinary agricultural purposes, and it is very desirable that every encouragement should be given to their propagation as well as introducion to Doab. These are now in great want for sugar-mills in sugar-producing districts. But, on the other hand, there are very few carts or occasion for them in the tracts bordering on Chambal. There is, similarly, very few charas to be drawn, and even those few are so small (like that of the eastern districts) as not to be bigger than three-fourths of a charas used in western districts, where, owing to the evenness of the surface, carts are in general use. Consequently, for Doab districts, where carts are in great use and charas is of a full size, Chambalpár cattle are not very serviceable. Besides Chambalpár cattle we have had a few cattle from the country lying about the Guna cantonment. These cattle are generally known by the name of Taintua and are styled Dungiri in the neighbourhood of Lucknow. These are said to be capable of existing on scanty provision and they can bear much hardship. These are of a very strong constitution, well-knitted in body, generally of a yellow color, with long and twisted horn more inclined towards the back, their tails being always thicker than usual. These are at once fit for draught as well as other purposes of agriculture.

7. We distribute prizes for cattle since last year. Dr. Willmott's report for the last fair and Mr. Buck's notes have some very useful remarks as well as suggestions about cattle, their classification and improvement. We have very judiciously confined our prizes to bullocks most suitable for agricultural purposes by excluding bullocks which are of a height above 50 inches. Our prize-giving is very much liked by the people, and indeed the Government patronage will soon have the effect in our province and its adjacent tract to improve the breed of cattle. This year we have acted up to the ideas of Mr. Buck. The committee for distributing prizes, under the Presidentship of Mr. Lawrence, Collector of Agra district, consisted of Mr. Baillie, officer in charge of Batesar Fair ; Kunwar Adhár Singh, younger brother to the Maharaja of Bhadawar ; Ahmad Yar Khan, Resaldar of Scindia's army ; Ganga Bakhsh, Bakhshi of Bhartpur State ; Kunwar Muchul Singh, Kundun Singh, and Thakur Umrao Singh, my elder

brother. The committee selected Chambalpari and cross-bred bullocks as most suitable for all the purposes of agriculture. Lots of cattle were brought forward for competing, and the task of selecting them was a difficult one. Mr. Lawrence, assisted by several native gentlemen present, did the business of selection himself. In selecting the cattle for prizes, the services of Jaikishan Jamadar so kindly sent to us by Major-General Angelo, Superintendent of Hissar Government Cattle Farm, were very useful. We distributed 40 prizes to the amount of Rs. 336 as following:—

Oxen 3 years old, 9 prizes to the amount of Rs. 70,—Rs. 15, 12, 10, 8, 7, 6, 5, 4, 3.

Exhibitors in this class were mostly people living along the coast of Chambal. Persons who obtained 7th and 9th prizes were, respectively, people from Mainpuri and Farukhabad districts.

Oxen 3 years old, 3 prizes amounting to Rs. 26,—Rs. 15, 7, 4.

The 1st prize was obtained by a cultivator from Mainpuri district, and the 3rd one by a cultivator from Aligarh district.

Oxen 2½ years old, 6 prizes amounting to Rs. 50,—Rs. 15, 10, 8, 7, 6, 4.

The 1st prize was obtained by a cultivator from Mainpuri district, and the 3rd one by a cultivator from Aligarh district; the other prizes having gone to the people of the Gwáliar Ráj.

Oxen 2½ years old, 3 prizes amounting to Rs 26. All these prizes were obtained by the people of Gwáliar Ráj—Rs. 15, 7, 4.

Oxen 2 years old, 5 prizes amounting to Rs. 43,—Rs. 15, 10, 8, 6, 4.

The 1st and 4th prizes were obtained by cultivators from Mainpuri district, and half of the 3rd prize by a cultivator from Muttra; the rest having gone to the people of the Gwáliar Raj.

Cows in calf 5 prizes to the amount of Rs. 45,—Rs 20, 10, 5, 5, 5. All of these were exhibited by Mewátis. Cows in milk, 3 prizes amounting to Rs. 32,—Rs. 15, 10, 7. These also were obtained by Mewatis, otherwise called Bepáris. There were two sets of prizes for yearlings, in all 6 prizes, amounting to Rs. 44. All of these prizes were obtained by Mewatis,—Rs. 10, 8, 8, 10, 5, 3.

8. Hitherto there was a very common practice of letting loose a bull of possibly higher breed at the death of a rich zamindar, which used to serve the cows of its neighbourhood. Now this practice has nearly fallen into disuse, and, on the other hand, there has not sprung up anything to supply the desideratum of a bull. It seems, therefore, very desirable that there should be a good Hariana bull for serving "desi" cows (Chambalpari as well as of Doab); thus a breed will be obtained which will at once be fit *for all the purposes* of agriculture—carting produce, drawing water, and ploughing with some improved plough. It is admitted on all hands that cross-breeds by judicious breeding in and in improves. We have a splendid example before us of horse breeds. Since the Government stallions have served our mares we have much improved our horses in the last 20 years.

9. In concluding this report I beg leave to suggest that bulls from Government Hissár Cattle Farm, not less than 54 inches in height, may be stationed at different localities, under the charge and care of respectable landholders, for serving the "desi" cows of a height not less than 44 inches. Those who have bred cattle know well that if a small cow is served by a large bull (with a difference more than 10 inches between the height of the bull and that of the cow), the calf comes out much emaciated in body, and the cow cannot afford to milk its calf in sufficient quantity proportionate to the large frame of the calf. If we have got such bulls we will in the course of a few years have good oxen, fit subjects for our prizes to encourage the breeders and to supply the want of good agricultural bullocks.

APPENDIX D.

Mr. Wilson's Report on Reh Experiments.

The sum alloted in the budget of the Awa estate for preparing plantations in *usar* during the past year was Rs. 1,200. This was supplemented by an equal sum out of the grant of Rs. 3,000 which is at the disposal of the Department of Agriculture and Commerce for agricultural experiments in these lands. The total sum, Rs. 2,400, was considered sufficient to plant 60 acres of land.

The areas taken up for planting are—

	Acres
In Awagarh	10·62
„ Jarauli, north of road	13·26
„ ditto, south ditto	35 44
„ Jaithra	4·73
Total	64·05

The expenditure up to the end of September is as follows :—

	Rs.	a.	p.
Paid by the Awa estate	1,017	9	0
Ditto Agricultural Department	1,074	12	8
Total	2,092	5	8

Of this Rs. 127-1-9 has been spent in starting a nursery of young plants (shisham, tamarisk, &c.), which it is proposed to plant out this year, and Rs. 68-11-0 in the purchase of tools, leaving Rs. 1,896-8-11 as the actual expenditure in preparing 64 acres of plantation.

In preparing the plantations the following systems have been tried :—

(i) Holes were dug 3′ deep, 3′ wide at top, and 2′ wide at bottom, and then refilled with the soil that had been taken out of them. Good soil was added to some of the beds.

(ii) Holes were dug of the same size as in (i) and the soil was inverted, the earth excavated from one hole being thrown into the next. Good soil was added to some of the beds.

(iii) Holes were dug 2′ wide and 2′ deep and the soil inverted.

(iv) Channels were dug 1′ deep by 1′ 6″ broad at the top and 9″ broad at the bottom, and the soil made into a ridge on one side. Part of the ground was ploughed before the channels were dug. Seeds were sown on the ridge.

(v) The ground was first ploughed with one of Ransome and Sims B. F. O. ploughs, and then prepared in a series of ridges 6″ high and furrows 6″ deep. The ridges are 10′ apart.

The areas prepared on the different systems are :—

	Acres.
(i)	8·92
(ii)	45·03
(iii)	1·10
(iv)	8 58
(v) ...	0·42
	64·05

In order to raise the seed-beds prepared under systems (i) and (ii) above the level of the *usar* plain good soil was added. This was obtained at Jaithra from some sandy waste ground near the plantation. At Awagarh and Janauli pits were dug, in which sandy soil was reached at depths varying from 3 to 6′ below the surface and continued to the percolation level (11 or 12′ from the surface). At first this good soil was put on only about half the beds in the plantation, but it was afterwards added to the remainder, as it was found that the seeds germinated very badly without it.

The boundary ditches were made by excavating 1′ 6″ deep of earth, which was piled up for a hedge to a similar height.

The seeds first sown did not germinate. A shallow trench (about 6″ wide and 4″ deep) was then dug in the bank and filled with good soil; in this the seeds germinated freely.

Seeds of kikar, chaunkar, and nim were sown. The kikar has done best.

Some of the beds are irrigated from wells by means of *gharas* fixed in the ground, and the rest by means of channels running alongside the beds and filled with canal water.

Of the plans described above, the last three have completely failed; no seeds having germinated, except in a few patches where the channel passed through comparatively good soil. Of the beds prepared on the first plan about 5 per cent., and of those made on the second plan about 15 per cent., now contain plants. The latter is the system recommended by Mr. Greig in his note on the Purdilnagar *usar* plantation in the Aligarh district. At the end of July most of the beds contained young plants, but few of them were strong enough to last during the six weeks that ensued without rain. The total rainfall measured at Awa from June to September was 10′ 5 inches.

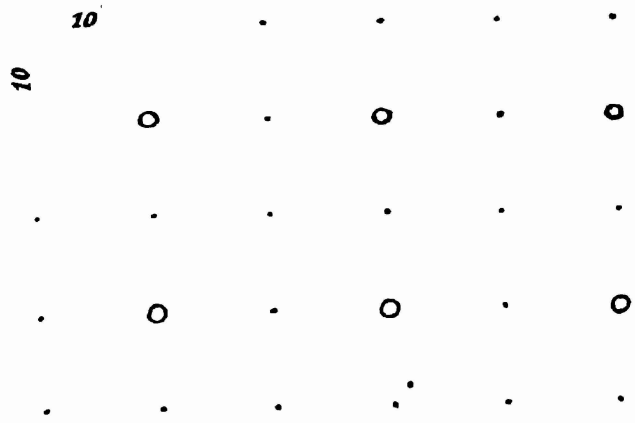
I propose during February to plant out some shisham and nim trees at distances of 40′ in the Awagarh plantation. Before the end of the rains it will be necessary to put more good soil on the rest of the beds which do not contain plants and to resow them. To cover this expenditure and to irrigate the plants now living about Rs. 1,200 will be required."

The work done on the usar plantation up to the end of December is described in a note in the Awa estate file (printed above). I should have mentioned that it was intended to plough between the beds and sow madar (*Calotropis procera*) in a large part of the land taken up. Owing to the scanty rainfall only 2·5 acres were thus treated. This was ploughed with Ransome and Sims' B. F. O. plough. The madar seed did not germinate. There is now more efflorescence and less grass in the land that was ploughed than in the remainder of the plantations.

In February 185 shisham trees were planted 40′ apart in the Awagarh plantation. The trees were one year old and 5 to 7′ in height. About 80 per cent. of them appear to be doing well. They are watered by means of pipes 3″ in diameter and 18″ long, fixed vertically about 6″ from the trees. Pipes are better than *gharas*, as the water is more likely to get down to the tap-roots of the trees. They are, however, much more expensive. Hemp (*patsan*) has been sown round each tree, to protect it as much as possible from the sun's rays. Dry leaves, too, have been freely used with the same object.

The failure of the kikar sowings last July should, I think, be attributed entirely to the scanty rainfall. Owing to the accumulation of saline matter in it *usar* soil is very impervious to water, and the light rain of July to September did not penetrate to any depth below the surface; the plants, consequently, got very little moisture. Some of the plants which came up from the seed first sown in June and had the full benefit of the rains' have done well, but they are generally in the lower parts of the ground where the water remained longest. I feel certain that had the average quantity of rain fallen, the plantations would have proved a success.

When starting such plantations in future, it may be advisable to prepare the beds 20′ apart more carefully than the intermediate beds. Thus :—



The beds marked o should be dug 3′ to 4′ deep and of the same width, and should be covered with 6″ of good sandy soil, while the intermediate beds marked · may be dug 2½ feet deep and 2½ feet wide and covered with only 3″ good soil. If the rains are light seeds sown in the beds marked o will probably succeed, though those sown in the intermediate beds may fail; if the rains are good, I think that all will succeed.

A number of plots of *usar* were treated with different manures. In the recent work on artificial manures by M. Geo. Ville, the author states that all but four of the ingredients required for plant-growth are present in nearly every soil. These four ingredients are phosphorus, potash, lime, and nitrogen. Any of these substances that may be required must be supplied by manuring. The normal manure for one acre of cereals, which is to be used when all form of the ingredients are required, consists of—

					lb.
Calicic superphosphate	...	...	...	...	352
Potassic nitrate	...	...	...	...	176
Ammonic sulphate	...	...	..	...	220
Calicic sulphate	...	...	...	...	308

M. Ville shows that if six plots are prepared and manured as follows :—

(i)	With normal manure.	
(ii)	Ditto	minus phosphorus.
(iii)	Ditto	ditto potash
(iv)	Ditto	ditto lime.
(v)	Ditto	ditto nitrogen
(vi)	Not manured.	

and if each plot is sown with the same amount of grain, a comparison of the produce of the different plots will show in which of the four ingredients the soil is wanting. For instance, if the produce of plots (ii) and (iii) is as good as that of (i), while that of (iv) and (v) is inferior, we may infer that the soil contains sufficient phosphorus and potash, but not enough lime and nitrogen to bring the crop to maturity.

The normal manure for one acre of leguminous crops, which get a great part of their nitrogen from the air, contains—

					lb.
Calicic superphosphate	...	...	...	...	352
Potassic nitrate ...	..	...	...	...	264
Calicic sulphate ...	...	...	...	...	264

Eleven plots of *usar* were prepared and treated with artificial manures in the manner suggested by M. Ville. Wheat was sown in six and peas in the remaining five. Owing to the scanty rainfall and the hardness of the soil it was necessary to irrigate the ground with canal water before it could be properly prepared. The canal was closed till late in the season, so that the plots were not sown till near the end of November. The ground was ploughed four times with Ransome and Sims' B. F. O.

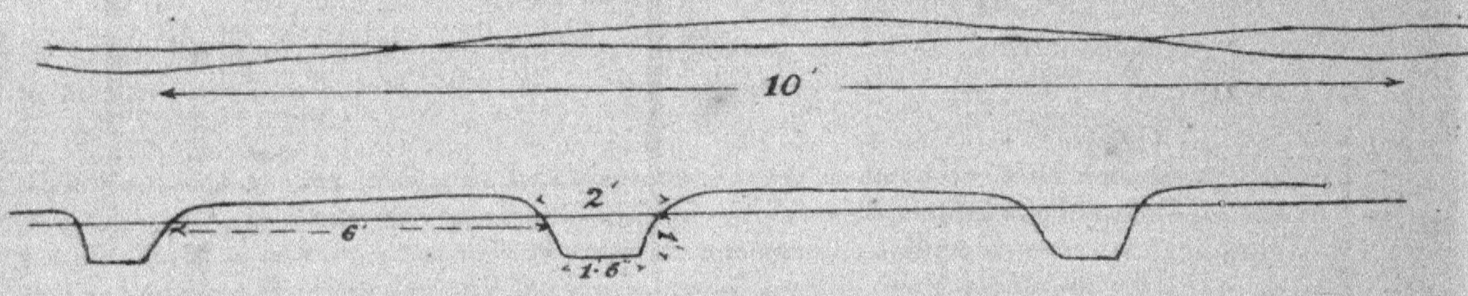
plough, and once with a country plough before sowing. The seed germinated poorly, but about equally, in all the plots, but the plants made no progress: their leaves turned yellow and most of them died. A few plants scattered over the plots are still living, but are less than 6″ high. Half of each plot was irrigated once in January. Other plots prepared in the same way treated with stable manure and indigo refuse and sown with wheat and peas have also failed to produce a crop.

In order to find the best manure for kikar (*Acacia arabica*), a piece of cultivated ground on the borders of an *usar* plain was taken up. Stable manure and indigo refuse have proved decidedly more effective than Mr. Ville's artificial manures.

I may mention that I did not anticipate much benefit from the application of mineral manure to *reh* soil, which already contains an excess of saline matter, but tried it in order to make the experiments more complete.

Various experiments have been and are being tried in order to remove the *reh*.

(*i*) *Surface drainage.*—A plot of land previously ploughed with Ransome and Sims' B. F. O. plough was prepared in a series of ridges and furrows (fig. 1), the ridges being 10′ apart, and the height from bottom of furrow to top of ridge 1′. In another piece of land small channels were dug as shown in fig. 2, the earth excavated being used to raise the ground between the channels.



It was hoped that the rain would wash the salt out of the ridges into the furrows and channels. There certainly appears to be more *reh* in the furrows than in the ridges, but the latter are not yet clean enough for cultivation. Indigo and jowar were sown on the ridges during the rains; a few seeds germinated, but the plants died before they were 6″ high. The ridges were then manured with mineral manures, farm-yard manure (10 and 21 tons to the acre), and indigo refuse (10 tons to the acre); wheat and barley were sown, but the few plants that appeared very soon died.

(*ii*) *Scraping the reh off the surface.*—A piece of ground that was treated in this way before the rains had decidedly less efflorescence on it in January than the surrounding land. If the saline matter had sufficient commercial value, it might be washed out of the soil that is scraped off and the solution evaporated. Mr. Buck called my attention to the experiments that are being made by the Salt Department to obtain sulphate of sodium pure enough for use in tanning. For this purpose there should not be more than 5 or 6 per cent. of chloride of sodium mixed with the sulphate. In samples that I have tried I have found too much sodic chloride. Further experiments will, however, be made in this direction.

(*iii*) *Sub-soil drainage.*—Under this head two experiments are in progress:—

(*a*)—By means of pipes, on the system so largely adopted in clay lands in England. For this purpose 4,000 two-inch pipes with collars have recently been given to the department by Mr. MacDonald of Aligarh.

(*b*)—By opening up the surface soil, so as to allow the rain-water that falls on it, or the canal-water that is used to flood it, to penetrate to the more porous sub-soil.

Usar soil is very impervious to water. This is due to the spaces between the particles of soil being filled up by saline matter. I have had pits dug in different places that I have visited to ascertain the nature of the strata from the surface of the ground to the percolation level. The upper stratum, which contains an excess of salts, is light-colored and very hard; it is called by the natives *kar usara* or *patparra usara*; it is from 1′ 6″ to 3′ 6″ in thickness. Below this I have always found a stratum either of loam or clay containing kankar most frequently nodular, but sometimes in blocks. Below this the soil is in some places clay, in others a sandy loam, known as *bhaswa*. In the land taken up for plantations at Awagarh and Jamauli this stratum is reached at depths varying from 3′ 6″ to 8′ 6″ from the surface. The thickness of the different strata vary considerably in pits not more than a furlong apart.

In places where the porous substratum is within 3 or 4′ of the surface, deep ploughing or digging may have a beneficial effect. The cost of digging is high; but if the experiment succeeds, the same work can be done much more cheaply by the steam plough now being worked in the *kâns* lands of Bânda. In such places, too, great benefit may be anticipated from planting trees, the roots of which will penetrate and open up the surface soil.

A survey is to be made of 65 villages in the Akrabad pargana. Ten villages are to be measured annually and 55 quinquennially. Up to the present the surveys of 22 villages have been completed. The *reh* patches in the fields have been measured by the amins and plotted to a scale of 40′ to an inch.

Statements have also been compiled from the kanúngos' papers of these 65 villages, giving the area of different crops cultivated in the kharíf and rabi seasons of 1879-80, classified according to the method of irrigation.

Measures have been taken for the preparation of a *reh* map of the provinces. Returns have been obtained through the district officers, giving the area of *usar* in each village and stating whether efflorescence appears in it or not. It was at first intended to prepare a provincial map simply showing in what villages *usar* existed; but as this did not show adequately the distribution of *usar* over the provinces, a map is now bring prepared, giving the proportion which the area of *usar* bears to that of the culturable land in different parts of the province.

In order to find the distribution of salts in a vertical direction, a number of specimens of soils have been collected and the saline matter washed out of them. A further report on this subject will be made when all the samples collected have been worked up.

An apparatus was made on the plan suggested by Mr. Medlicott to find the evaporation from subsoil water. The apparatus is intended to give the amount of evaporation from a water-table 4′ below the surface of the ground. It was made at the canal foundry, Roorkee, and was received in June, too late to be erected before the rains. Since my return from leave I have had it filled with soil on the plan recommended by Mr. Medlicott, but as soon as the water drained out of it, the soil cracked away from the sides of the box. The soil used was taken from a cultivated field near an *usar* plain; as it may have contained more clay than usual, I am getting it filled again very slowly with soil taken from another field.

Arrangements are being made to test the percolation through *usar* by means of a gauge similar to that used by Messrs. Lawes and Gilbert in their experiments at Rothamsted. This gauge, which I saw recently when on leave, is made by underpinning and building round a piece of ground *in situ*.

In order to test the decomposability of the soil a lysimeter has been prepared as recommended by Dr. Center in his recent "note on *reh* or alkáli soils and saline well waters."

ORDERS OF GOVERNMENT.

No. 982 of 1881.

FROM

THE SECRETARY TO GOVERNMENT,

N.-W. PROVINCES AND OUDH,

TO

THE OFFG. DIRECTOR OF AGRI. AND COMMERCE,

N.-W. PROVINCES AND OUDH.

DATED NAINI TAL, THE 22ND JUNE, 1881

SIR,

REVENUE DEPARTMENT

I AM directed to acknowledge Mr. Wright's letter No. 200G., dated the 11th April last, and appendices, being the Annual Report of the Department of Agriculture and Commerce, for the year ending 31st March, 1881. Almost all the important topics treated of in this general report have formed the subject of separate special reports, on which suitable orders have already been passed. It is unnecessary to go over the same ground again in much detail, and I am in reply to communicate a few brief remarks.

2. *Village records.*—The Board of Revenue have borne testimony to the zeal of the Director and his Assistant in this part of their duties, and it is satisfactory to learn that a great improvement in the records has resulted from the introduction of the new rules. Mr. Wright considers that the position of the Director, as the Board's Inspector of patwáris and kanúngos, is likely to impair his influence in connection with matters of agriculture. It was indeed stated by the Government, when reviewing the report for the last year, that when the new rules for the preparation of agricultural records had received their final form, and had been generally introduced, and the supervising staff was in good working order, it might be advisable to relieve the Director of the duty of controlling the work of District Officers in this respect. The rules, however, have not yet been finally settled, and the time has not yet come for relieving the Director of this part of his duties, or finally deciding that it is advisable to do so.

3. *Traffic registration.*—(*a*) *Foreign.*—The posts were all inspected during the year.

(*b*) *Road.*—Statistics of road traffic are collected with the object of enabling the Public Works Department to decide on the maintenance or abandonment of some of the metalled roads, and the advisability of constructing provincial light railways.

The results of the first year's registration are not yet known, but every effort seems to have been made to ensure accurate registration.

(*c*) *Railway.*—In the registration of railway traffic, two important changes have been made : (1) a table has been drawn up for calculating

for each class of goods the net weight, as deduced from the gross weight shown by the railway officers ; and (2) European and Indian piece-goods on the East Indian Railway have been shown separately.

This branch of the department has been under Mr. Fuller's charge, and his supervision has been careful and intelligent.

4. *Construction of State wells.*—This subject has been separately discussed in correspondence ending with G. O. No. 626, dated 22nd April, 1881, to the Secretary to the Board of Revenue. There are not sufficient data before the Government to allow of a conclusion being formed as to whether the wells which have been constructed are in all respects suitable for field-irrigation. Further information is desired on this point, showing whether a full supply of water exists in them at all seasons of the year.

Further experiments in the construction of wells are being made on the Awa Estate, and the results should be separately reported.

5. *Reh experiments.*—Appendix D. gives in full Mr. Wilson's report of the measures adopted by him to get rid of *reh* in some *úsar* plains in the Awa Estate. He planted out 64 acres with trees, at a cost of Rs. 2,092, on five different systems,—three of which completely failed, while in two a small degree of success was obtained. Experiments in surface drainage were tried with the object of removing *reh*. With the object of utilising it, preliminary operations in glass-making were started, but the results were not very satisfactory.

A provincial *reh* map is being prepared, showing the area of *úsar* in each village, whether efflorescent or not, which should be very useful in dealing with the general question of *reh* and its causes.

6. *Eradication of káns.*—The report under this head gives a short history of the arrival of the steam-plough in Bánda. The results obtained from the working of the plough are, however, not shown, and nothing is said about the present state of the *káns*-infected tracts. This is a very important subject, and His Honor looks specially to your department for information and advice in connection with it.

7. *Arboriculture.*—His Honor regards the extension of arboriculture as one of the greatest importance to the country at large, and hopes that the Director will use every effort to promote the planting of trees by private persons throughout the provinces.

8. *Public gardens.*—Mr. Wright recommends that the Táj gardens at Agra and the Khusru Bágh at Allahabad should be placed under the supervision of the department, and that the superintendents of those gardens, as well as those of the Saháranpur and Lucknow gardens, should be classified departmentally. The annual departmental report should be a *resumé* of results, not a series of suggestions for change of system, which are matters for separate discussion. It should be remembered that these gardens are kept up for their historical interest, and to be in keeping with the beautiful buildings to which they appertain, quite as much as for their horticultural importance.

9. *Sericulture.*—The Government has now almost concluded the transfer of silk cultivation to the eminent English firm of Lister and Co.; and the proposal to establish plantations of mulberries in the hills, for the purpose of cottage-rearing, has not yet taken any practical shape.

10. *Tobacco and the Kumaun orchards.*—The Government has no direct connection now with the cultivation and curing of tobacco, and the subject has been separately reported on. The surplus receipts from the tobacco farm, leased to Messrs. Begg, Sutherland and Co., are devoted to experiments, of which the orchards in Kumaun form an important part. These orchards are doing well under the management of Sir Henry Ramsay.

11. *Improvements in breed of cattle.*—In this branch little practical work has been done beyond the granting by Government of prizes for cattle exhibited at district shows. The subject has, however, been fully discussed, and the question of establishing a cattle farm is under consideration. The result of the experiments undertaken by Mr. Crooke on the Awa Estate should be fully reported.

12. *Experimental farms.*—Paras. 51 and 52 are out of place in this report. If the existing arrangements are not satisfactory, the matter should be separately referred to Government, as also such questions as the advisability of establishing an agricultural school and publishing an agricultural manual.

The results obtained in the Cawnpore farm, though vitiated to some extent by the short rainfall of 1880, have not been thrown away. The conditions under which deep-ploughing is advantageous, the value of indigenous as compared with imported cotton, and of country juár when compared with some other imported fodder plants,—have been established; and the acknowledgments of Government are due to Mr. Fuller for the care and ability which he has shown in the management of the farm.

13. *Workshops.*—Here satisfactory progress has been made. Good work has been done in perfecting the Kaisar plough, and other implements may before long be adopted and perfected. Mr. Wright's remarks in para. 61 of the report, as to the duty of the department as a pioneer, are reasonable and just.

14. *Court of Wards' estates.*—The work done in the three estates, which are in charge of officers in communication with the Director, has been separately reported on. The proposal in para. 66, to bring another of the large estates into communication with the department, now that the work in the Awa Estate has been fairly started, seems a good one.

15. The extent to which the co-operation of native landholders has been secured is one of the most satisfactory features of the year. Mr. Wright hopes every district will soon have an agricultural institution, and would utilise the energies of enterprising landholders in these institutions, instead of letting them be wasted in experimenting on their *sir*. This may be sound advice, but the practice on private lands of what the department teaches must in no way be discouraged. Pandit

Ajudhia Prasád of Sháhjahánpur still exhibits a lively interest in the improvement of agriculture, and Rája Jagat Singh has established at Bijnor an agricultural institution with an experimental farm attached. These gentlemen are setting an example which it is hoped that others may follow in due time.

16. The general results of the year, as described in the report, may look somewhat meagre; but, as already observed, most of the subjects have already been separately reported on and discussed more fully. The work of the department cannot be fairly judged by this brief summary of its operations. His Honor is satisfied that the department is doing good work. Every day the reasons for its establishment are becoming more fully recognised, and the benefits arising from it admitted. For the future its efforts should be directed to working quietly but energetically, and enlisting the sympathies of officials and people in the cause of progress.

I have the honor to be,

SIR,

Your most obedient servant,

C. ROBERTSON,

Secretary to Government,
N.-W. Provinces and Oudh.

FOURTH ANNUAL

REPORT ON THE ADMINISTRATION

OF THE

DEPARTMENT OF AGRICULTURE AND COMMERCE,

NORTH-WESTERN PROVINCES AND OUDH,

FOR THE YEAR ENDING 31ST MARCH, 1882.

ALLAHABAD:

NORTH-WESTERN PROVINCES AND OUDH GOVERNMENT PRESS

1882.

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No. 480G OF 1882.

DEPARTMENT OF AGRICULTURE AND COMMERCE, N.-W. P. AND OUDH.

DATED CAWNPORE, THE 4TH SEPTEMBER, 1882.

FROM

THE DIRECTOR, DEPT. OF AGRI. AND COMMERCE,
NORTH-WESTERN PROVINCES AND OUDH,

TO

THE SECRETARY TO GOVERNMENT,
NORTH-WESTERN PROVINCES AND OUDH.

SIR,

I HAVE the honor to submit the fourth annual Report on the Administration of this Department for the year ending 31st March, 1882. The report last year was sent in on 11th April, 1881, and was too early to make use of the special reports on the various branches of work in the charge of the Department for the year with which it dealt. In order to make my account of this year's operations intelligible I have been obliged in a few instances to refer to events which occurred before its commencement. The only important report for the past year which is outstanding now is that on the Railway-borne trade of the Provinces. Mr. Fuller has taken the materials for that with him; and I expect it every day. In the meantime he has sent me a short note on the administrative action of the Department in this line, which I have incorporated with my report. The subjects which fall within the scope of the Department's action are so numerous and so varied that, though I have tried to make this account complete, it is possible that I have not been able to guard against oversights.

I.—PATWÁRIS AND KANÚNGOS.

2. The maintenance and compilation of a body of village statistics which shall put Government and its officers in possession of an adequate knowledge of the actual condition of the rural population, its resources, and its wants has been pointed out by the Famine Commission as one of the chief needs of the country, and been assigned by the Government of India as one of the principal duties of its Agricultural Department. I therefore take this subject first. It is treated in detail in the Administration Report of the Board of Revenue, and only an outline of what has been done and the main results of the work appear to be required here.

3. **Inspection.**—As much of our time as was not taken up by miscellaneous duties which it was impossible to avoid was spent by Mr. Fuller and myself in camp and devoted to the supervision of the kanúngo and patwári staff. We each of us lost at least a month by fever, and the number of tahsíls inspected was less than it should have been in more favourable circumstances. Detailed notes of the results of inspection were forwarded to the District Officers, and abstracts to the Board. Very bad work was punished by fine, and in one case it was found necessary to recommend dismissal. In the majority of the districts the records were found to be trustworthy and kept up to date. In others, where they were in a less satisfactory condition, they were not so bad but what the defects could be remedied by moderate care and attention. In Basti and Gorakhpur a number of concurrent causes which were not found together in any other part of the Provinces which we visited rendered imperative the adoption of special measures, and definite proposals were submitted to the Board of Revenue. As no general statement can convey a clear idea of the merits of the village

records, or where or to what extent they may be depended on either to show the present condition of the rural population, or to form a basis for future assessments, I append a short account of the state in which they were found in each district separately.

In one particular very great improvement was noticed on the state of things described in last year's report. The general employment of kanúngos on work other than what properly belongs to them was found in one district only. In a few others, if there were occasional infractions of the Board's rule, they were not so frequent as to give the kanúngos any reasonable excuse for the neglect of their duties :—

Sahâranpur, two tahsíls.—The patwáris' papers were fairly accurate, but the maps were not corrected up to date and the bahikhatas were not ready for the entry of kharíf payments.

The supervisors had generally all but completed both testing tours by the middle of March. Their testings for the rabi were fairly good, but they did not commence their kharíf testing tours till long after the prescribed date, and their testings were too late to be of any value.

The work of the registrar-kanúngos was much in arrears, but the compilation, where done, was accurate.

The sadr-kanúngo had not been on tour for two years.

Muzaffarnagar, two tahsíls.—The village records contained very few errors. The maps were excellent and generally corrected up to date. In some parts the admirable system of reproducing corrected maps on cloth had been introduced. The only fault was that the preparation of the bahikhatas was much in arrears.

The supervisors had generally done their field testing work well, and in some cases had taken their papers for office testing with them into their circles instead of doing the work at the tahsíl—a practice which saved time and does not appear to have led to any inconvenience.

The registrars had brought their returns up to date, but the haste which had been necessitated by the occurrence of previous arrears led to some inaccuracy.

The sadr-kanúngo had performed his duties of inspection with energy and with good results.

Meerut, one tahsíl.—The work was good throughout, except that the patwáris had not prepared their bahikhatas. The khasras were accurate, the maps corrected up to date and faired out on cloths. The supervisors had finished their kharíf partal and were well advanced with the rabi. The registrar-kanúngo had completed his returns for the year with the exception of part IV. of the mahál statments. The sadr-kanúngo had been on tour, and the excellent results obtained might fairly be ascribed to the unusual interest in the work which was taken by the covenanted district staff.

Bulandshahr, three tahsíls.—The work in this district was good : the village papers very accurate, and all of them, including bahikhatas, up to date. The supervisors had generally spent sufficient time on tour, and in every case the registrars had completed their returns seven months within the time given them for the work. The sadr-kanúngo was actively employed in testing village papers during the greater part of the cold weather.

Aligarh, a portion of one tahsíl.—The patwáris' papers were excellent, well written, very accurate, and all up to date. The supervisor's work was only moderately good ; but the sadr-kanúngo had done really good testing work, and for the last five years it had been the custom of the district staff to spend a great deal of trouble in systematically testing the khasras—a custom which had borne excellent fruit, not only in increasing the accuracy of the papers, but in improving the intelligence of the patwáris.

Muttra, six tahsíls.—The patwáris' papers were excellent. Of 1,771 entries tested only 3 per cent. were inaccurate. All but two supervisors had done good work, though some of them were very late in commencing their testing tours. Except in one case, the registrars' papers were well up to date and very accurate. The only general fault to be found was the omission to supply the patwáris with printed copies of their village maps.

Mainpuri, one tahsíl.—The inspection took place very early in the season. The registrars' papers were fairly advanced, and the supervisors had tested a considerable number of villages for the kharíf, though not nearly as many as they should have. The village papers of the preceding year had all been filed.

Etah, three tahsíls.—The patwáris' papers were remarkably accurate and well up to date. The supervisors had nearly finished filing the papers of the past year, but were generally very backward with their testing tours. The work of the registrar-kanúngos was accurate and well advanced.

Farukhabad, two tahsíls.—The defect in this district was in the patwáris' papers, which were frequently so inaccurate as to be nearly useless. The patwáris themselves appeared to be disobedient to orders and very much out of hand. The wôrk of the kanúngos, on the other hand, was good. The supervisors had filed nearly all the papers of the year before and, though their kharíf tours were begun too late, had tested more than the usual proportion of their villages. The registrar's papers, though inspected early in December, were nearly complete for the year. The sadr-kanúngo had inspected every tahsíl twice during the preceding, and four tahsíls in the present year.

Bánda, one tahsíl.—The patwáris were in the habit of writing up their rabi and kharíf jinswars in the same tour, which is objectionable, though not likely to produce such grave error as in districts where double-cropped land and irrigation are more common. The supervisors had tested a fair proportion of village papers on the spot, but should have done more. The registrar's papers were well advanced and accurate. The sadr-kanúngo had employed himself in testing papers on the spot—a practice which should be more generally insisted on.

Bareilly, two tahsíls.—In one tahsíl the work was particularly good, both supervisors and registrars having, by end of February, completed what was practically their whole work for the year. In the other the registrar had completed his returns for the year, but the supervisors had not tested all their villages, though more had been done than in many districts. They had been interrupted by diluvion work. The errors in patwáris' papers not generally numerous.

Pilibhít, two tahsíls.—The patwáris' papers were generally good. The local testings by supervisor-kanúngos very inadequate and often entirely neglected. This was not always the fault of the supervisors. The staff is deficient and has other work which employs most of its time. Proposals have been sanctioned for increasing it in the most over-worked tahsíl. The registrar's compilation was good and almost finished for the year. The sadr-kanúngo had been less on tour than he should have been.

Moradabad, three tahsíls.—The patwáris in the parts of the district visited in camp were absent from their villages, and an unduly large number were admittedly non-resident. This was the first district I had seen, and I did not properly understand how supervisors' work should be tested. The registrar's work was in great confusion and the arrears more considerable than in any district subsequently inspected. The sadr-kanúngo had done no inspection this year; he had only visited four out of six tahsíls since he had been in office, and he had never been in camp for local testings.

Sháhjahánpur, four tahsíls.—The patwáris' papers generally untrustworthy. The supervisors had neither tested the papers of the year before, nor made any effort to carry out the local testings for the current year. In many instances their patwáris'

registers had not been written up for two years. In three out of the four tahsíls their diaries showed that eight supervisors had not done on an average more than one day's work apiece in a month since the beginning of the year. The registrar's work was considerably in arrears, but not inaccurate as far as it went, and real attempts were being made to bring it up to date. The sadr-kanúngo had been on tour. Mr. Mulock is exerting himself to bring about a better state of things.

Basti, five tahsíls.—The area of patwáris' circles is generally too large. An unduly large number are non-resident. The maps are usually either very bad or absolutely useless, the village papers of no real value. Of 23 supervisor-kanúngos, 18 had done no office testing work at all and only one had completed it. Their field-testing tours were not commenced till long after the proper date, and rarely maintained for more than a few days at a time. A few supervisors had made some attempt to test their khasras on the spot, but many had done this for lesst han a tenth of the villages in their circles. The work of the registrars is not so bad as that of the supervisors, but it is still in arrears ; and even if brought up to date, the compilation of untrustworthy statistics would not be of much use.

Gorakhpur, one tahsíl completely, five partially.—The supervisors were distinctly worse in the matter of field testings than even at Basti, though they were slightly better in filing their papers of the year before. The condition of the village papers, and particularly of the máps, has long been a matter for complaint.

4. Only four divisional examinations fell within the year under report—namely, those at Meerut, Agra, Allahabad, and Benares. The following statement shows the results :—

	Examined.	Passed in all subjects.	Passed in some subjects.	Failed.
Sadr-kanúngos	4	2	1	1
Registrars	54	19	17	18
Supervisors	145	51	74	20
Candidates	114	33	40	41
Total ...	317	105	182	80

The following statement shows the number of kanúngos on the roll who have or have not passed :—

	Total number of kanúngos	Total number passed.	Total number not passed.
Sadr-kanúngos	30	27	3
Registrars	162	119	43
Supervisors	421	290	131
Total ...	613	436	177

The examinations are sufficient guarantee against hopeless incapacity, and have no doubt done much to raise the efficiency of the staff. It is to be regretted that, though a knowledge of the simple rules of mensuration is secured, the difficulties in the way of examining a large number of men at the same time in the practice of plane-table survey have prevented the introduction of that subject.

5. Raja Shankar Singh of Etah has displayed a public-spirited interest in the efficiency of the patwári and kanúngo staff of his district, and on 15th October, 1881, opened a school of surveying, in connexion with the High School of Etah, which he maintains entirely at his own expense. He has presented it with a complete set of surveying instruments and books, and defrays the salary of an experienced Surveyor, who was appointed on the recommendation of Colonel Anderson of the Revenue Survey and teaches in subordination to the Head Master of the High School. The

class at present numbers 18 pupils, chiefly sons of kanúngos or patwáris, and the subjects taught are surveying, Hindi, Rules for patwáris and kanúngos, and the Rent and Revenue Acts. The conditions on which the establishment of the class was sanctioned by Government were that it should be open to boys in general, and to such kanúngos and patwáris as might be able to attend it, and that attendance should not exempt any pupil from the ordinary examination test before he is appointed to any post on the patwári or kanúngo staff.

6. The annexed table shows the number of the patwári and kanúngo staff employed in each district :—

Statement showing the number of patwáris and kanúngos in the N-W.P.

District.	Patwáris.	Kanungos.			
		Sadr.	Registrar	Supervisor	Total
Dehra Dún	39	1	2	...	3
Sahárunpur	608	1	4	16	21
Muzaffarnagar	451	1	6	15	22
Meerut	611	1	6	16	23
Bulandshahr	498	1	4	12	17
Aligarh	731	1	6	15	22
Total, Meerut Division ...	2,938	6	28	74	108
Bijnor	532	1	5	12	18
Moradabad	823	1	7	18	26
Bareilly	681	1	6	16	23
Pílibhít	338	1	3	8	12
Budaun	608	1	5	10	16
Sáhjahánpur	499	1	4	11	16
Total, Rohilkhand Division ...	3,481	6	30	75	111
Muttra	454	1	6	15	22
Agra	615	1	7	18	26
Mainpuri	458	1	5	10	16
Farukhabad	643	1	6	15	22
Etáwah	397	1	5	10	16
Etah	543	1	4	14	19
Total, Agra Division ...	3,110	6	33	82	121
Cawnpore	957	1	9	22	32
Fatehpur	615	1	6	13	20
Banda	788	1	9	20	30
Allahabad	1,264	1	11	24	36
Hamírpur	570	1	6	13	20
Jaunpur	641	1	10	...	11
Total, Allahabad Division ...	4,835	6	51	92	149
Azamgarh	1,078	1	5	30	36
Mirzapur	494	1	4	8	13
Gorakhpur	1,286	1	6	23	30
Basti	879	1	5	25	31
Gházipur	625	1	8	...	9
Benares	429	1	4	...	5
Ballia	472	1	5	4	10
Total, Benares Division ...	5,263	7	37	90	134
Jalaun	454	1	5	7	13
Jhansi	265	1	4	4	9
Lalitpur	184	1	2	2	5
Total, Jhánsi Division ...	903	3	11	13	27
Tarái	117	1	*5	2	8
Total, Kumaun Division ...	117	1	5	2	8
Provincial Total ...	20,647	35	195	426	658

NOTE.—Tahsili kanúngos in permanently-settled districts have been counted as registrar-kanúngos.

* Four of these are both registrars and supervisors.

II.—TRAFFIC REGISTRATION.

7. The system of traffic registration followed during the year under report differed in no material respect from that of the previous year. The registration is possessed of a three-fold character, according as it deals with (*a*) Foreign traffic, *i.e.*, traffic with the countries of Tibet and Nipal; (*b*) Internal road traffic; and (*c*) Railway traffic. The first of these is registered under the orders of the Government of India, who bear a moiety of the cost of registration. It is of insignificant dimensions compared with the traffic which crosses other portions of the provincial boundary, and, so far as provincial interests are concerned, its registration yields no special advantage in the absence of a like registration along the remainder of the provincial frontier. Registration of the second class of traffic—*i e*, that carried along roads within the provincial limits—is undertaken with the special object of providing the Public Works Department with a body of statistics which should be of great benefit in the determination of questions relating to the utility of metalled roads or the extension of railway communication, and in acknowledgment of this benefit the Public Works Department bears a portion of the cost of registration. The registration of the third class of traffic, that, namely, borne by railways, is one of the peculiar functions of this Department, and the returns form one of the most satisfactory and useful fruits of its action. The cost of registration is however borne by the Government of India in the case of traffic carried along all lines except the provincial ones connecting Hathras with Muttra and Farukhabad with Cawnpore.

8. The following was the total cost of traffic registration during the year under each of these heads:—

	Borne by Government of India.	Borne by local Public Works Department.	Borne by this Department.	Total.
	Rs. a. p.	Rs. a. p.	Rs. a p	Rs. a p.
Registration of foreign traffic along the Tibet and Nipal frontiers.	2,188 8 0	*Nil.*	2,426 0 0	4,614 8 0
Registration of internal road traffic for Public Works Department purposes	*Nil*	4,000 0 0	8,852 0 0	12,852 0 0
Railway traffic registration	8,040 0 0	*Nil.*	600 0 0 Paid to C F L R	8,640 0 0
Total	10,228 8 0	4,000 0 0	11,878 0 0	26,106 8 0
Add cost of compiling staff ...	...	...		4,821 0 0
Ditto inspecting staff	...	...	...	1,200 0 0
GRAND TOTAL	...	...	...	32,127 8 0

9. I add some brief remarks on the working of each class of registration during the year under report:—

Foreign traffic registration.—This was affected by means of 28 posts maintained—5 on the Tibet and 23 on the Nipalese frontiers, and representing an establishment of 39 native clerks or muharrirs. With the exception of the change in locality of a single post, that at Tikolia in the Kheri district having been shifted to Palia, and a few promotions and degradations in the salary of individual muharrirs, the registration machinery was exactly the same as that of the previous year.

All the posts on the Nipal border were visited by native Inspectors attached to this Department, but those on the Tibetan border were found to be too remote to admit of their sharing this advantage. This is only the second year in which the policy has been pursued of tightening the control of this office over the registration muharrirs by means of the supervision of departmental officials instead of trusting entirely to the district authorities, and judging from the increased punctuality of the returns and their greater *primâ facie* accuracy, the system has borne excellent fruit. The results of the year's registration have been already communicated to Government in the annual Foreign Trade Report which was submitted with my No. 870, dated 25th

August, 1882, and there appears to be no reason for recapitulating them here. I may mention that the total value of the whole traffic, import and export, only amounted to a crore of rupees, or about one-twelfth of the value of the annual traffic of the City of Cawnpore, which sufficiently indicates its present unimportance. But, although lost amidst the great and increasing commercial activity of these Provinces, the traffic is of vital importance to the Nipal Darbar, yielding in its taxation a large annual income, and its existence is therefore a serviceable pledge for the continuance of amicable political relations. It cannot be said however that the Darbar shows any indication of an enlightened policy in the imposts which it levies upon this traffic. Indeed, the rates according to which duty is levied and the method of its exaction offend against every accepted canon of taxation. The Darbar has however so far conformed to modern international usage as to furnish the Resident with schedules purporting to show the tariff on which taxes are taken at the different customs posts along the frontier; but the lists are so indefinite in form and so contradictory in detail as to be of but little practical use, even did not grave suspicion attach to their veracity. Such as they are however they have been carefully checked and recompiled in this office. The schedules relating to the western portion of the frontier were translated and circulated amongst the trading classes during the year under report, and the remaining schedules will be similarily treated during the current year.

10. **Internal road traffic registration** —During the preceding year the complete registration had been effected of all traffic passing along metalled roads in the Benares, Allahabad and Jhánsi Divisions as well as on some unmetalled roads in Bundelkhand and the trans-Ghagra tract, with special reference to the projected extension of railway communication in those regions. During the year under report the registration establishment was transferred to the metalled roads of the Meerut and the Rohilkhand Divisions, with the exception of a few posts in the Bánda district, the maintenance of which was continued for a second year in order to gain grounds for the calculation of an *average* traffic. The registration of traffic has now been completed on the metalled roads of all the districts in the Meerut Division except Aligarh and of the whole of the Rohilkhand Division, and a report on the statistics which were obtained has been submitted with No. 911S, dated 20th September. During the current year registration is in progress on the metalled roads of the Agra Division and of the Province of Oudh. This will leave only the district of Aligarh to be taken up in 1883-84 in order to provide a complete series of road traffic returns for the whole of the Provinces, which can hardly fail of being of great value if weight is to be attached to definite information in deciding such questions as the maintenance of costly metalling on a road or the direction to be taken by a projected line of railway I am aware that grave objections may be raised to any system of collecting statistics by means of native clerks who are free from close supervision, but I have not found any reason for doubting an *approximate* accuracy of these returns, which is sufficient for all practical purposes. Every effort has been made to eliminate all preventible causes of error; no clerks were appointed without having previously shown their competence in examination, and each post was inspected twice by native officials attached to this Department. I may add that practical use has already been made of some of the returns collected during the year under report in drawing up reports at the request of the Public Works Department on the prospects of two projected lines of railway,—one to connect Meerut (or Delhi) with Moradabad and the other to connect Bareilly with Kásganj in the Etah district.

11. **Railway trade registration.**– This is out of all comparison the most important part of the Department's duties in connection with traffic registration, and its results have been found of practical utility in the commercial world as well as of service to Government. The issue of quarterly abstracts of traffic for publication in the *North-Western Provinces and Oudh Gazette* was continued, and a full report on the traffic of the whole year is now under submission to Government which renders any notice here superfluous. The only modification in registration which the year witnessed was

a return to the former system of "block" demarcation by *revenue divisions* instead of by *railway sections*. This involved greater labour in compilation, but materially increased the intelligibility of the returns. During 1880-81 the "blocks" into which the Provinces were divided were as below:—

Name of block.	Stations which it included.
UPPER DOAB	S. P. D. R. stations Sirsawa to Ghaziabad.
MIDDLE DOAB	E. I. R stations from Dadri to Agra and stations on the Muttra-Háthras Light Railway.
LOWER DOAB	E. I. R stations from Firozabad to Manauri.
ALLAHABAD	E I. R. stations from Allahabad to Majgaon.
BENARES	E. I R. stations from Kurchana to Gahmar.
ROHILKHAND-OUDH	O and R. R stations from Aligarh to Alamnagar, including stations on the Moradabad branch line.
OUDH-BENARES	O. and R. R. stations from Lucknow to Benares, including stations on the Cawnpore branch line.

But these names conveyed no certain idea of area or extent without detailed explanation, which it was necessary to reiterate on almost every occasion of their mention. As now reconstituted the blocks are as follows:—

Name of block.	Stations which it includes.
MEERUT DIVISION	S. P.D. R. stations Sirsawa to Ghaziabad. E. I. R stations Ghaziabad to Háthras. O. and R R stations Rajghat to Aligarh Muttra-Hathras Light Railway stations Háthras to Mursan.
AGRA DIVISION	E. I. R. station Jalesar to Phaphund. Muttra-Hathras Light Railway stations Barhan to Muttra-Cawnpore-Farukhabad Light R. stations Araul to Farukhaabad. Agra R. S R. stations. S. S. R stations Bhandoi to Station.
ALLAHABAD DIVISION	E. I. R. stations Jhinjhak to Nawai and Jasra to Majgaon. O. and R. R. Jalalganj to Shahganj and O R. R. Cawnpore station. Cawnpore-Farukhabad Light Railway Cawnpore to Bilhour.
BENARES DIVISION	E. I R stations Garpura to Gahmar, including Benares and Tarighat. O. and R. R. Benares to Phulpur.
ROHILKHAND DIVISION ...	O. and R. R. stations Babrala to Kahilia, including stations on Moradabad branch line.
OUDH	O. and R R. stations Aujhi to Bilwai, as well as those on Cawnpore and Bahramghat branches (except Cawnpore city).

12. As Government is aware the actual process of registration is effected in the railway audit offices, and since it is based upon the invoices, or in other words on the revenue vouchers of the railway, the returns are free from liability to error except of a merely clerical nature. The work of this office is therefore restricted to checking the returns on their receipt from the various audit offices, their compilation and the calculation of values, which involve however an amount of labour sufficient to tax to the utmost the powers of the staff which is allotted for it. The work of the Department was also considerably increased by its holding the position of the representative of the Government of the Panjab, the Lower Provinces of Bengal, the Central Provinces and the Division of Ajmir, in dealing with the East Indian Railway Audit Office, which effects the registration of by far the greater portion of the traffic of Upper India.

III.—MANUFACTURES.

13. On receipt of G. Os. Nos. 424, dated 16th February, and 799, dated 5th August, 1881, along with other papers from the Secretary of State on the subject of

Indian manufactures, Traffic Inspectors attached to this Department were sent to the following towns to collect information of the handicrafts noted against each town :—

Mirzapur and Muttra	Brass ornamental wares.
Moradabad	Metal inlaid wares.
Lucknow	Silver inlaid wares.
Ditto	Jewellery and bidri work.
Mainpuri	Tarkashi (inlaid wood work).
Nagina (Bijnor district)	Carved ebony work.
Bareilly	Furniture.
Agra	Mosaics.
Bánda	Pebble manufacture.
Azamgarh	Pottery and satinette.
Aligarh	Ditto and check cloth.
Amroha	Pottery.
Rampur	Ditto.
Cawnpore	Leather work and check cloth.
Lucknow	Embroidery.
Mirzapur	Carpets.
Jhánsi...	Ditto.
Jaunpur	Scents.

The points that were enquired into are :—

(1.) Number of firms employing labor : (*a*) first class, (*b*) second class workmen.

(2.) Number of independent workmen ditto ditto.

(3.) Amount and its value turned out by each class of laborers in a week.

(4.) History of the craft, with details as to the processes employed and implements used.

14. The following are the principal factories in the provinces from which returns were received showing their working during the past year. The returns have been compiled and submitted to Government :—

Cawnpore Cotton mills.
Ditto Woollen do.
Lucknow Paper do.
Shâhjahânpur Sugar factories.
Mirzapur Lac factories and Indigo factories.

The points that were enquired into were :—

(1) Name of factories or mills.
(2) Capital, if a joint stock company.
(3) Average number of persons employed.
(4) Yearly outturn.

Information regarding factories other than indigo was given by the owners.

Returns of Indigo factories were received from all the Collectors.

NORTH INDIAN MANUFACTURES.

15. A permanent imprest of Rs. 5,000 is placed at the disposal of the Department to enable it to maintain a shop where the art manufactures of these Provinces can be introduced to the travelling public. Messrs. Laurie and Staten's Hotel at Allahabad was selected as the most favorable site for an emporium of the kind, and, besides articles actually for sale, it was provided with a number of priced samples of goods which could be supplied to order. These samples have through some unexplained misunderstanding been themselves sold. The account with the Treasury stood as follows at the end of the year :—

Balance due at commencement of the year.	Drawings during the year.	Payments during the year.	Balance due at end of year.
Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
4,329 3 1	3,968 5 9	4,855 1 8	3,442 7 2

The assets of the fund are as follows :—

		Rs	a	p.
1	Value of stock with Laurie and Staten	2,371	14	7
2.	Owed by Laurie and Staten for sales within the year ...	480	2	0
3.	Value of stock at Cawnpore office	144	8	0
4.	Advances recoverable	409	3	1
5.	Imprest in hand	100	0	0
6	Debts from others than Laurie and Staten	474	12	3
7.	Value of shop furniture (say)	50	0	0
	Total assets ...	4,030	7	11

The excess of assets over the balance due at the Treasury (Rs. 588-0 9) represents profit and insurance. The sales effected through Messrs. Laurie and Staten were as follows :—

Items.	*Supply accounts*						Sale account.			Balance in hand on 1st April, 1881.		
	Unsold stock from previous year			Supplied during 1881 82								
	Rs.	a.	p.	Rs	a.	p.	Rs	a.	p	Rs.	a	p
Ludhiana cloth	200	8	3	...			22	8	0	178	0	3
Azamgarh satinette	117	2	5	187	6	9	75	9	0	229	0	2
Nagina ebony	81	12	4	216	11	0	73	8	0	224	15	4
Mainpuri tarkashi	26	10	4	72	6	6	37	0	0	62	0	10
Moradabad ware	210	0	3	471	3	0	307	4	0	373	15	5
Benares brass ware	63	15	9	..			...			63	15	9
Lucknow silver inlaid ware	21	7	3	754	9	7	402	12	3	373	4	7
Gorakhpur brass ware	56	11	2	...			...			56	11	2
Muttra silver work	7	10	0	...			...			7	10	0
Mirzapur pottery	93	0	4	...			...			93	0	4
Azamgarh pottery	...			30	14	6	30	14	6	..		
Multan pottery	35	8	9	114	10	3	127	12	9	22	6	3
Bánda pebbles	...			32	4	3	.			32	4	3
Agra inlaid ware	...			400	15	3	...			400	15	3
Jaunpur papier maché	..			210	4	0	2	8	0	207	12	0
Dacca silver work	49	5	0	...			3	6	0	45	15	0
Total ...	963	11	10	2,491	5	1	1,083	2	6	2,371	14	7

16. Besides the shop at Allahabad independent sales to Messrs. Dresser and Holmes of Farringdon Street, London, and Messrs. Watson and Co. of Bombay, were made of the wares of shisham wood inlaid with brass wire which are manufactured under the direct supervision of the Department at Mainpuri. The account of this manufacture is given.

Value of goods received			*Sales*			*In hand*		
Rs	a.	p	Rs.	a	p	Rs	a	p.
1,514	2	1	1,677	7	0	144	8	0

There was a small stock in hand at the commencement of the year.

Messrs. Dresser and Holmes have since notified that they do not wish to continue the purchase of these wares. The imprest is also used to purchase articles, when necessary, for exhibitions. Some account of the action of the Department in this line will be given in the section of this report in which its connexion with exhibitions is dealt with.

IV.—WELLS.

17. The most important of the duties for which Captain Clibborn was attached to the Department was the conduct of an analysis of the Province district by district, with the view of ascertaining in which directions, and under what conditions, an extension of irrigation by wells is possible. He was in camp from the beginning of November till nearly the end of April. His tour traversed portions of the following districts :—

Cawnpore.	Muttra.
Jalaun.	Aligarh.
Hamirpur.	Bulandshahr.
Bánda.	Meerut
Unao.	Muzaffarnagar.
Lucknow.	Saharanpur.
Hardoi.	Bijnor
Farukhabad	Moradabad.
Mainpuri.	Bareilly.
Etah.	Shahjahanpur.

and careful experiments on the well irrigation actually in existence were made at each camping-ground. The result is by far the largest collection of facts relating to this subject with which I am acquainted. The information has been tabulated and submitted with a short introductory note by Captain Clibborn.

18. Early in 1880 arrangements were made for the conduct of special experiments at Moradabad, with the view of ascertaining (*a*) in what way we can best deal with landlords and tenants; (*b*) in what way we can most economically construct masonry wells with a full supply of water. The first period of the work on the Moradabad wells was spent in experiments of various kinds conducted by Mr. Mills, the Engineer in charge, with a view of throwing light on question (*b*). The form of well decided on was a masonry reservoir sunk to such a depth only as would allow the free play of the bucket at a period of greatest exhaustion. This was to be continued by a tube down to the depth where a copious supply of water was obtainable. Both the material of which these tubes could be best made and the most serviceable gauge were the subject of a very large number of generally inconclusive experiments. In May, 1880, Mr. Mills fell ill, to the great loss of the undertaking; but by that time it had been determined that gular wood piping of 5 inch diameter (a suggestion which Mr. Mills owed to Mir Muhammad Muhsin Khan of Amroha) should be adopted. Besides this, a very excellent sand pump, which is likely to play an important part in well-sinking in the future, had been constructed for clearing the way for the tube. When Mr. Mills left, charge was taken by Mr. Alexander, the Settlement Officer; and though the heavy duties of his office left him but little leisure, he found time to make repeated visits to the wells all through the hot weather and rains. Some progress was made in construction and arrangements were made with cultivators and zamindars for the recovery of the money to be invested by the State.

19. From December, 1880 to the end of the last official year Captain Bellasis had charge.

20. At the commencement of the year under report Mr. Meares was sent to Moradabad as District Engineer, and was given charge of the wells in addition to his ordinary duties. The work accomplished up to this time was as follows :—

In one old well, which had been disused owing to the failure of the water, a pipe had been sunk by Mr Mills down to the clay, which was pierced and gave an abundant supply of water. Two old wells had been built up and sunk deeper. In one an iron pipe had been sunk.

Twelve masonry cylinders had been built and sunk; five were half built and sunk and two half built, but not sunk.

At one well the bricks had been collected.

Wooden pipes had been sunk in two and one clay pipe had been sunk and broken. During the year under report twenty-three wells have been quite finished—that is to say, the cylinders have all been built and sunk and pipes let down to as great a depth as our present knowledge allows us to think necessary.

21. In September, owing to representations from Mr. Meares to the effect that he was unable to carry on the work at the wells concurrently with his District duties, Mr. Sub-Conductor Edwardes was appointed to assist. He failed to give satisfaction, and at the end of January Mr. Meares was relieved of his district work and appointed to sole charge of the wells, which he retained till the close of the year.

22. In October Mr. Wilson visited the wells with me and tested the eleven which at that time we found fully completed. Our trials showed, that, except in two, where the cylinders rested on clay, and the old Hasanpur well, the cylinders filled with sand as soon as any considerable strain was put on them. Unless this defect were remedied the wells were nearly useless and threatened to be altogether engulphed. Mr. Meares therefore rammed in a bottom of kankar in each of the wells which rested on sand, the full effect of which has not as yet been ascertained. In May last

Captain Clibborn inspected the wells and put down in one of them a bottoming of impervious concrete, which secures that all the water in the well should come up through the tube. Trial waterings have been made from this, with results which, though inconclusive, are not wholly unsatisfactory. With the sinking of the masonry and pipes the main labor and expense is at an end. All that now is required is careful experiment to find out the actual value of the completed wells, and perhaps to suggest a few easy and inexpensive alterations.

23. The original number of wells projected in the direct charge of the Engineer was 28. Of these five have been given up and 23 have been completed.

The total expense, including charges for tools and experiments, but excluding the salary and travelling allowance of the supervising officers, has been (as nearly as I can ascertain from the accounts now before me) Rs. 19,705-5-2.

24 Besides the wells in charge of the Engineer, Mir Muhammad Muhsin Khan has undertaken the construction of 17, and received an advance on account of Rs. 4,528-12-7. A zamindar (Jwala Prashad) in Sambhal has also received an advance of Rs 1,000 on account of three wells to be built by himself. There remains to the credit of the Well Fund Rs. 53-15-4 in cash and Rs. 2,888-15-7 at the Moradabad treasury.

25. *Jaithra wells.*—Mr. Crooke is spending the large sum of three lacs of rupees in providing parts of the Awá estate with wells. The operations up to date have been in the charge of Mr. Wilson, whose services have been placed at Mr. Crooke's disposal by this Department.

In 1880, two wells were sunk and finished; but as the structure of the cylinder varies according to whether the well should draw its supply from percolation or from a spring, it was thought unsafe to go on sinking until trial borings had discovered the nature of the sub-soil The first tool used for this purpose was an auger working at the end of an iron rod in a 3-feet tube; but it was found that in a sandy soil this process was so slow and expensive as to be practically useless. A single boring cost Rs. 27 and took three weeks. Mr. Wilson therefore ordered a new pattern of sand pump in November last. This consists of a cylinder some 5 feet long, with a valve in the bottom opening upwards. A piston, also furnished with a valve, works inside the cylinder, being lifted from above by a rope and allowed to fall with its own weight. By lifting the piston three or four times the cylinder is filled with sand, which is then withdrawn. Clay has to be broken by a jumper before the pump will take it up, or if very viscid, condensed into lumps by sand poured down the hole and mixed in. This instrument was supplied in May, and since then 27 borings have been made to an average depth of 27 feet each, at a cost of Rs. 3 each for labor and Rs. 5 if the price of the instrument be charged.

26. The wells in course of construction at Jaithra are of three kinds:—

(1.) Spring wells, in which the masonry rests on clay.

(2.) Spring-wells, where the masonry rests on sand and the water is drawn from a tube continued from the cylinder and piercing the clay.

(3.) Percolation wells drawing their water from the surrounding sand. In each case where the cylinder does not reach clay, it is furnished with a solid concrete plug to keep the sand from coming in at the bottom.

In places where the clay stratum is within such a distance of the surface that a cylinder of the depth wanted for irrigation will rest on it, there can be no question of using any form of well but the first. Where the clay stratum is further from the surface, it is a problem which has yet to be decided whether the tube well or the percolation well is cheaper or more stable or gives a better supply of water. Until this is decided Mr. Wilson will not sink the cylinder in any place, except for experiment, where it has not been shown by the borings that the first class of well can be made.

27. Up to date 18 wells have been built and sunk to depths varying from 20 to 30 feet below the percolation level, of which six have reached clay, and pipes have to be sunk in the remaining twelve. When this has been done, the twelve tube wells will be tried against twelve percolation wells. The cylinders have been commenced in 20 others. Further work on them is suspended till the question of tube or percolation is decided. Of the 27 borings made, clay has been reached in the case of 20 at a depth which will allow the ordinary well to be made.

As it is impossible to get gular wood at Jaithra, Mr. Wilson has decided to use iron tubing, It costs more, but is easier to sink. The best size is shown to be 5 inches in diameter.

28. The results of Captain Clibborn's enquiries and Mr. Wilson's experiments, as well as of those conducted at Moradabad, will, it is hoped, shortly form the subject of a communication to Government.

V.—REH AND GLASS.

29. A note by Mr. Wilson on his experiments with a view to reclaiming reh is appended at the end of this report. They were of various kinds :—

1. By planting trees.
2. Grass.
3. Manures and crops.
4. Mechanical, *i.e.*, by drainage.

The kinds of tree experimented with were nim, shisham, farrash, kikar (babul), and chaunkar. Of these the first two require a larger amount of attention and water than can well be afforded. Kikar and babul will grow with very little irrigation and can either be sown *in situ* or transplanted— the latter plan being best, provided that the plants are taken up when very young, as the shoots from seeds planted *in situ* are liable to be killed by heavy rain. The seed rarely germinated unless a layer of from three to six inches of moderately good soil was put on the surface. The ordinary usar of the bed was loosened to a depth of three feet, to admit of penetration by the tap root. There does not appear to be much use in attempting plantations of this kind unless canal water can be obtained. The cheapest way of applying canal water is by shallow channels running along each seed bed.

30 Many varieties of usar grass have been discovered and named by Mr. Duthie. Of these the khar usara is by far the best, and experimental weighings on unirrigated land, where it had been properly protected, gave in the first year an average outturn of more than 30 maunds, or from 1 to 1½ tons to the acre, while on irrigated land the produce reached two tons to the acre. Only it is absolutely essential to the proper growth of this grass that cattle should be excluded. They tread down the shoots, tear up the young roots, and prevent its growth or extension. Mr. Duthie has sent Mr. Wilson some Australian salt plants, one of which—the *Artiplex nummularia*—promises to do well. None of the manures tried and none of the special crops gave any return. Green soiling with hemp proved equally unsuccessful.

31. The mechanical means attempted were surface drainage, subsoil drainage, and flooding and allowing the water to stand. None of these had any effect. Mr. Wilson has reason to doubt the accuracy of the theory that reh deposits are formed by the drainage of soluble salts from the higher to lower levels, and thinks, on the contrary, that the prevalence of reh on low tracts is mainly due to erosion. He finds that there is usually a very thin deposit of rather better soil on the surface of usar plains on which grass will grow. If this is washed away nothing is left but the salt underneath it, which is absolutely barren. He thinks that a thin humus might be deposited by the formation of silt beds from the canal, and that the usar grass is sure to do good by arresting drainage and the accompanying erosion.

32. **Reh-survey.**—Elaborate measurements have been made in 65 villages in the Akrabad parganah to determine whether or no reh is on the increase. The change, if any, is very slow, and trustworthy results cannot be expected from the measurements of only a few years.

33. **Usar-map.**—With the exception of a few parganahs where the returns had to be sent back for explanation, a map has been prepared showing the extent of usar in every village in the Doab and in a part of Rohilkhand.

34. In November last Mr. Buck and Dr. Schlich visited Awa, and I had the advantage of being present. The results of Mr. Wilson's experiments were thought sufficiently encouraging to warrant the proposal of a scheme for the enclosure of very large areas of usar land. In pursuance of this scheme two plots of usar have already been taken up in the neighbourhood of the Experimental Farm and are being fenced.

35. **Glass**—Experiments in glass manufacture have been continued by Mr. Wilson during the year. His chief object was to ascertain whether a better material could not be produced from the reh by the use of furnaces made on the English pattern than the rough glass which is manufactured in the Aligarh and Etah districts. The native fashion of manufacture is to put the reh soil, in which the saline matter has previously been concentrated by evaporation on the surface of the soil, into a large closed furnace holding from 300 to 600 maunds. They keep this burning for about eight days, feeding with indigo refuse through a small aperture in the side. When it cools, the kanch is found in a block in the middle and broken up with picks. The objections to this material are that it is not colorless and that it is full of bubbles and impurities. In order to drive off the impurities and gases a much higher temperature is required which will completely liquify the glass. This Mr. Wilson has attempted to obtain by the use of an improved furnace and fire-clay crucibles, in which the kanch manufactured by the native method could be remelted. A satisfactory form of furnace was determined in the past cold weather, the dimensions originally chosen having been repeatedly altered during the course of the experiments. Four crucibles have been obtained from Messrs. Brown of the Raniganj pottery which have all of them burst one after the other. The article on glass in *Spon's Encyclopædia of Industrial Arts* says that a crucible must stand for at least a year before it is put in the furnace, and this precaution was not observed.

36. Besides the experiments with the European furnace or crucible, Mr. Wilson has used the tools he brought from Venice on glass manufactured on a slightly improved modification of the native plan. He melts the native kanch again, and when it is very hot plunges it into cold water. The result is to crack it all over—a process which appears to expel much of the air and leave the glass more homogeneous. A large collection of native beads was obtained for patterns from officers in every part of India; but as yet only the simplest form of bead has been attempted, with the object of teaching the natives employed the use of implements. Two men—one of them a clever glass-maker from Lucknow—and a boy are employed, and have certainly improved in the regularity with which they cut the tubes. But at present they can only cut one tube at a time, whereas a Venice workman can cut as many as twenty.

37. Mr. Wilson's conclusions may be thus summarized:—

(1) That there is no use to try to make good colorless glass like English window glass in these Provinces, as the reh is not sufficiently free from impurity.

(2) That if a good furnace is constructed of fire brick with reservoirs, a material can be made similar to common bottle glass; much superior to kanch and probably cheaper.

(3) A glass furnace requires so much care, both in building and working, that it would probably be advisable to employ a European who thoroughly understands the work for its supervision.

(4) That good beads can be made, but that, unless the men can be thoroughly instructed in the use of the implements, it may cost more to make them here than to import them from Venice.

The experiments will be continued during the current year, chiefly in bead manufacture.

VI.—ARBORICULTURE.

38. This used to form the subject of a separate report. G. O. No. 1343 (Revenue) of 31st July, 1882, directs that, instead, notice should be made of it in the annual Administration Report of the Department. The total number of miles of road under operation in each Division, with the cost, is shown in the following table :—

Name of division.	Under operation.	Newly taken up	Cost.
	Miles.	Miles.	Rs. a. p.
Meerut	172¼	28½	6,149 9 6
Rohilkhand	128⅞	26¼	3,873 11 2
Agra	138½	50	4,531 15 7
Allahabad	260½	48¼	6,265 8 9
Benares	153	122	2,639 11 4
Jhánsi	164½	68	7,772 0 7
Kumaun	19½	0½	195 0 0
Lucknow	34¼	6¾	1,538 3 7
Fyzabad	126½	56	877 15 0
Sitapur	60½	3	1,210 1 10
Rae Bareli	82	33	927 4 5
Total	1,340⅛	442¾	35,981 1 9

The totals last year were reported as 1,587½ under operation and 455½ miles of new road. As more accurate returns were asked for this year, it is possible that the falling off is not real. It will be seen from the following statement that the number of trees planted during the year under report was far greater than that of the preceding year :—

Name of tree.	1881-82.	1880-81.
Mango	25,574	20,082
Jamun	17,068	10,008
Ficus	7,565	4,324
Shisham	10,071	9,410
Nim	10,251	3,309
Tamarind	1,495	1,173
Mahua	5,838	1,789
Miscellaneous	17,213	15,948
Total	95,075	65,938

The number of nurseries maintained during the year was 132, as compared with 143 in the preceding year The number of plants at the end of the year was 309,953, as compared with 315,303 at the commencement. 73,925 seedlings were contributed to the roads this year. The year before the number was 60,011.

Three new groves were planted out during the year, and an area of 238 acres of old grove was under maintenance. The whole number of trees planted was 1,371.

39. The next statements show the expenditure and receipts of each Division :—

Expenditure.

Name of division.	Groves.	Nurseries.	Avenues.	Lopping and felling.	Total.
	Rs. a. p.	Rs. a. p	Rs. a. p.	Rs. a. p	Rs. a. p.
Meerut	119 4 0	441 4 3	6,149 9 6	296 2 10	7,006 4 7
Rohilkhand	...	701 10 0	3,873 11 2	317 10 6	4,892 15 8
Agra	64 0 0	1,007 11 10	4,531 15 7	156 4 0	5,759 15 5
Allahabad	9 0 0	1,247 12 9	6,265 8 9	375 15 0	7,898 4 6
Benares	560 14 5	2,201 3 5	2,639 11 4	61 0 0	5,462 13 2
Jhánsi	460 14 4	822 7 8	7 772 0 7	32 1 3	9,087 7 10
Kumaun	...	305 0 0	195 0 0	...	500 0 0
Lucknow	724 8 6	170 14 9	1,538 3 7	16 6 0	2,450 0 10
Fyzabad	...	200 11 3	877 15 0	...	1,078 10 3
Sitapur	...	77 9 6	1,210 1 10	87 15 0	1,375 10 4
Rae Bareli	...	453 1 2	927 4 5	...	1,380 5 7
Total	1,938 9 3	7,629 6 7	35,981 1 9	1,343 6 7	46,892 8 2

Receipts.

Name of division.	Felling.			Lopping.			Fruit.			Other sources.			Total.		
	Rs.	a.	p.	Rs.	a	p	Rs.	a.	p.	Rs.	a.	p.	Rs.	a.	p.
Meerut	8,971	12	6	4,340	1	7	827	8	1	64	8	0	14.203	14	2
Rohilkhand	1,886	3	3	321	7	6	81	8	0	230	15	0	2,520	1	9
Agra	3,862	2	1	477	5	9	576	6	0	...			4,915	13	10
Allahabad	5,899	9	11	223	0	3	970	14	0	902	10	0	7,996	2	2
Benares	778	8	7	524	1	6	2,398	4	0	156	6	0	3,857	4	1
Jhánsi	103	6	9	231	12	6	39	8	0	29	7	9	404	3	0
Kumaun	...			...			...			...			...		
Lucknow	180	12	0	170	15	4	32	1	0	12	0	0	395	12	4
Fyzabad	14	7	3	2	12	6	37	1	6	12	2	6	66	7	9
Sitapur	...			285	14	9	...			47	0	0	332	14	9
Rae Bareli	279	9	6	81	5	6	91	5	9	52	7	6	504	12	3
Total	21,976	7	10	6,658	13	2	5,054	8	4	1,507	8	9	35,197	6	1

The total budget grant for the year was Rs. 53,300, of which Rs. 52,293-5-0 was allotted to districts. The net cost to Government after deducting receipts was only Rs. 11,695-2-1. The year before the total expenditure was Rs. 38,740, and the net cost after deducting receipts Rs. 17,631. The returns were then not sufficiently accurate to enable the amount of each class of expense to be shown separately.

40. The increase in receipts this year is very striking and bears witness to the growing interest taken by district officers in the work. There is no reason to believe that it was anywhere prejudicial to the condition of the roadside avenues; it was rather the result of a more vigilant supervision which prevented the sacrifice of legitimate sources of revenue. The largest receipt in any district under any one head was that from loppings in Bulandshahr. It was obtained by a systematic dressing of the avenues along all the road, which is reported by Mr. Growse, who took a great interest in this work when he was at Muttra, to have much improved them. A similar dressing realized large profits in Budaun, and though it is an operation which will not bear frequent repetition, there are many other districts where it would well repay the attention of Collectors. The largest receipts from felling were realized at Cawnpore, chiefly in consequence of the number of trees cut down by the Farukhabad-Cawnpore Railway. In Aligarh and Mainpuri this branch of the revenue was swollen by the effects of heavy storms, which overthrew a number of the less vigorous trees, and was probably not altogether unattended with advantage in clearing the ground for stronger plants. In Partabgarh the felling of *babul*, which had been planted as a temporary protection to the more permanent avenues, yielded a good sum.

41. The most satisfactory item in the receipts is the large sum derived from fruit and other produce. Benares and Allahabad head the list with receipts of Rs. 2,001 and Rs. 750, while Aligarh comes next with Rs. 597; and it is obvious that it is in the neighbourhood of large towns that this kind of property can be made most valuable. Provided that the receipts are spent in adding to the comfort of wayfarers, there seems to be no infamy in extracting the largest possible profit from this source. At Azamgarh sarpat grass, and at Cawnpore the common grass on the pattris, yielded a considerable profit; and something was realized from lac at Allahabad. In fact there is no reason why, with a moderate amount of attention, the roadside avenues should not be made a valuable property, and not only support themselves, but yield a surplus that might be devoted to their extension. From this point of view, as well as on consideration of their service in times of scarcity, the planting of fruit and fodder trees is a matter of importance, and it is satisfactory to observe how large a proportion they bear to the total number of trees planted out this year. Both at Benares and at Allahabad efforts have been made to draw up maps and khasras, showing the boundaries of the roads and the trees planted on them—a work without which it will be difficult to derive their full value from roadside plantations.

42. The attempt to enlist the co-operation of native gentry and zamindars, which was warmly commended by Government in their review of last year's arboriculture report, is the subject of very conflicting opinions on the part of district officers. Great differences appear to exist in the natural disposition of zamindars even in contiguous districts. In Mainpuri for instance they are reported to exhibit an invincible apathy to arboriculture; but the Collector of Etáwah feels no doubt in being able to secure their warm sympathy, and the same officer, who was at Etah for the year under report, had much success in enlisting their interest. Raja Shankar Singh, whose public spirit in maintaining a patwári school at his own expense has already been mentioned, planted out the road from Kásganj to his ancestral home at Bilram; and Mr. Smith reports that the trees are well cared for. Lala Awadh Narain has planted out three miles of the road between Sakit and Aspur, and surrounded the ghát at Dumri with young and flourishing mangoes. Narain Das of Sirhpura and Chaudhri Nur-ullah Khan of Suhawar have each added a considerable number of trees to the district roadsides; and Ali Ahmad, the official Tahsildar of Jalesar, who has taken up the matter zealously, promises the co-operation this year of Rao Nitrpal Singh of Umargarh and other zamindars. Mr. Crooke maintains the avenues in the neighbourhood of Awa, and has arranged to dig holes on the Etah and Aliganj Road if the Collector will provide trees for them.

In Bareilly the Collector strongly recommends for the thanks of Government Lala Damodar Das, whose father's will imposed on him the obligation to plant the Moradabad road from Bareilly to the confines of the district. During the year under report he has added eight new miles to the seven he had already planted out, and Mr. McConaghey found the work good and the trees flourishing. Munshi Nirotam Das has promised to plant two miles near the city, where shade is wanted.

In Gorakhpur, 76 miles in different parts of the district have been dealt with by private persons and 4,020 trees planted. The best results are shown by Lala Jagmohan Das, who has planted out and maintains four miles on the Benares road.

In Azamgarh 4,296 trees have been planted by zamindars, who have erected substantial *thálás* for their protection on several miles of road, and success of the same kind is reported from Jhánsi and Jalaun. In Kheri the Commissioner mentions Raja Mailap Singh of Majhgain and the young Raja of Oel as deserving of special commendation.

43. From some districts—*e.g.*, Aligarh, Gházipur, Cawupore, and Sultanpur—the hostility between zamindars and cultivators is instanced as an obstacle to the planting of trees by either class This was the main difficulty found by Mr. Boys in introducing the scheme at Gonda, which was described in last year's report, but which has not met with much success or extension this year. Of Bánda the Collector remarks, with some justice, that where land is abundant people are not likely to utilize the sides of roads; but even then, where profit is wanting, name and sentiment might serve as motives, and there seems to be no reason for abandoning the view that much may be done by private means in any district where the Collector is fortunate enough to carry the people with him.

44. Though great divergence of opinion continues on the question of concentrating or scattering nurseries, there appears to have been no difficulty anywhere in procuring an ample supply of new trees. It is a subject on which it seems hazardous to lay down any general rule. The distances to be traversed and the quality of the roads will turn the scale between the conflicting advantages of better supervision at the sadr and proximity to the work at out-station nurseries. The best trees run a risk of being spoilt if they have to be carried great distances, and cost of transport forms a heavy item of expense. There is a general consensus of approval to the plan of utilizing the compounds of roadside bungalows as nurseries and the employment of mális as chaukidars. If a small addition to their pay were made from the arboricultural grant, there would be a good chance of securing the services of well-qualified men. Mr. McConaghey found this year again that there was no difficulty in buying as many saplings as were wanted at Bareilly from private growers, but nevertheless recommends the insurance of

a small and economically managed nursery to fall back upon in case of any failure in the supply. Mr. Twigg at Hamírpur makes a nursery impervious to cattle at a cost of from Rs. 80 to Rs. 100, by surrounding about a fifth of an acre with a five foot deep ditch surrounded on the inside by thick hedge of prickly cactus. This is provided with a pucka water channel and a stile for its approach. The advantages are that no chaukidar is required, a few hours' visit by a máli once a week suffices for attendance, and a pair of cattle hired for five or six days in the month for irrigation.

45. Mention was made last year of the want of success attending the large central nursery at Lucknow. Out of more than a lac of magnificent saplings only an inconsiderable number had been disposed of, and early this year I directed Mr. Ridley to take measures for closing it. At the same time it was generally made known that any one who wished it could have trees delivered free of cost in the nursery. I have no account of the exact number since disposed of, but I believe that I am well within the mark when I put it at more than Rs. 15,000. When I visited the garden last month it was full of applicants from every class of the community, and the demand shows no trace of flagging. Trees cannot be diverted to any other use, but are pretty sure to be planted when a man has paid the expense of carrying them away; and the advantage of stimulating arboriculture in the neighbourhood is perhaps worth the small expense of maintaining the nursery, even if the distribution of its produce be gratis. The total number of saplings in the nursery at the end of the year was 103,265. Arhar, in the second year of its growth, was found to be a better protection to young plants than the castor-oil tree. In connexion with the main nursery is a small exotic plantation which is maintained by a separate grant of Rs. 400. Among a number of new importations four sweet plums and 20 Arabian date palms are doing well, while 16 mahogany trees are making slow progress. There is a large stock of *Eucalypti*, of which the *resinifera* and *rostrata* are perhaps the most successful varieties. A small nursery is maintained at Gorakhpur, under the charge of Mr. Campbell, Assistant Conservator of Forests, in which garden and exotic trees are grown in addition to those usually grown on the roadsides. He has found this year again that pine-apples are effective in exterminating grass and has used linseed with the same result. His carobs are doing well; and he adds another to the innumerable reports of the utter failure of the *Prosopis glandulosa*. He has a good plantation of grafted mangoes and a few promising ground-nuts. In last year's report hopes were expressed of the plan of rearing jack seedlings, which will not bear transplanting, in hollow bamboos. Out of some 600 plants treated in this way only about 100 are now alive. The question of how to rear seedlings that will not bear transplanting has long engaged the attention of the coffee and cocoa planters of Southern India. Of all the plans adopted there, the simple one of sowing *in situ* not unnaturally proved the most successful, but it is only suited to garden cultivation, where the young plants can be carefully tended. Plants sown in bamboos did very well for the first year; but in the second the bamboo disappointed the expectations which were formed of it, and, instead of rotting away, suffocated the plant. None of the modifications of the plan which have been tried succeeded. There are two devices, either of which is almost certain to answer: the first is a basket of very thin strips of bamboo lashed together with bark, which is put into the ground with a sufficiently wide aperture in the bottom to permit of the exit of the tap root. The second is an earthen pot rather smaller at the top than at the bottom and open at both ends. This is put on a board or flat basket and put with the plant in the hole intended for it. A few taps disengage the earth inside, and the pot is withdrawn bodily, to serve for another occasion. It is probable that either of these would succeed as well with jacks, as they do with coffee plants. A third plan, recommended by Dr. McIvor, is the use of small pots made of clay and cowdung, and of a consistency and thickness which would ensure their decomposing rapidly when buried.

46. **Fences.**—The old earthen *thála* is generally reprobated. What should be substituted for it depends on circumstances. The new thála and ditch recommended in

the arboriculture report for 1879-80 is always spoken well of where the soil is fairly tenacious. In the report its expense was estimated at little over 2 annas, and the Collector of Bareilly reports that he has made them for 2 annas 7 pie each. This is probably the cheapest form of protection known, and for this reason, as it is efficient as well, it deserves general adoption; but in sandy soil some other fence must be used, as the inner wall is liable to be washed on to the plant and into the ditch. This is supplied in many districts by a thorn fencing. Bábul branches are used in Bánda and Hamírpur and a hedge of sihor in Balia and Gorakhpur. In cases like this it is necessary to take care that the thorns do not overhang and choke the young tree.

The Collector of Benares considers that a fence of sticks would be best, were it not that its material tempted the cupidity of passers-by. I half recommended this in last year's report and tried it myself on the Cawnpore Farm, but have found that it has the further disadvantage of being too feeble to resist cattle. Nearly all my stick fences have been knocked over, and I have substituted open brick-work. This is no doubt an excellent form of thála, but its expense is an objection where a large number have to made. They cost at Cawnpore 11 annas each. The conclusion is that on ordinary soils a ditch and bank is by far the best; but where there is an excess of sand, a thorny hedge is the best substitute, if it can be had. The case of a very sandy soil, which won't grow thorns, presents some difficulty; but there are probably few places which would answer the description. In one place wire fences from Roorkee costing four rupees each were tried, but this is a kind of extravagance which should be avoided. Under any circumstances open brick-work would be cheaper and as good.

47. **Irrigation.**—The reports of fourteen districts where it has been tried are unanimous in recommending the gharra system of irrigation. The only objection to it comes from Bánda, where Mr. McConoghey is said to have disapproved of it on the ground that the roots wind themselves round the gharra instead of going straight down. The same officer however, writing this year from Bareilly, approves of it on the whole, stating as his only objection the liability of the gharras to be broken—an objection which he proposes to overcome by making the bhistis pay for new ones. As the bhisti is the natural enemy of the gharra, it is possible that this plan might succeed in districts like Saháranpur, where the blame of breakages is attributed to the mischievous propensities of the boys. There is some difference of opinion as to the degree of porosity required At Hamírpur Mr. Twigg, who is continuing the use of the long pattern described last year, is trying to reduce it by painting two-thirds of the circumference with coal-tar. At Partabgarh, on the contrary, Dr. McReddie makes the pots more porous by the addition to the clay of one-fourth of its bulk of horse-litter. As a general rule gharras that run dry in eight or ten days are porous enough; but a clay soil requires less water than sand, and a mango more than a babul; and no general answer is possible. This is a matter which deserves attention.

It appears that the irrigation cart described last year as a new invention has been known for some years past at Bánda and Hamírpur, though its use had not spread beyond that neighbourhood. The further accounts received this year confirm the opinion expressed as to its value.

48. The great majority of reports this year show that a lively interest is felt in this branch of work and that considerable progress is being made. Half as many trees again were planted this year at a net expense of not much more than half that of last year. Where district officers take a personal interest and work through their Tahsíldars, as at Etah, Bareilly, Bulandshahr, and elsewhere, the best results are perhaps obtained; but in many districts the Engineer has done good work. It is fortunate for a treeless division like Jhánsi that it has officers who pay so much attention to the subject as Mr. Deas and Mr. Storey, and a Commissioner who gives them every support.

VII.—PUBLIC GARDENS.

49. The special reports for two years have been forwarded to Government since the submission of last year's administration report. There are two gardens under the control of the Department—one at Saháranpur, the other at Lucknow.

The **Saháranpur Garden** has throughout been in charge of Mr. Duthie, with a trained gardener, Mr. Gollan, as his Assistant Mr. Duthie was absent on leave to Europe for six months (April to October, 1880), and was deputed to deliver lectures on botany at the Forest School at Dehra in the autumn of 1881. He also made two botanical tours (for which a special grant of Rs 3,000 has been made by Government) in 1881, and visited Dr. King, the Director of the Botanical Gardens at Calcutta, proceeding with him to Darjeeling in connexion with special enquiries made from him by the Fodder Committee. During his absence from the gardens Mr. Gollan conducted the superintendence most satisfactorily.

50. The cost of the gardens has been as follows :—

	Total expenses.			Receipts.			Net cost.		
	Rs.	a.	p.	Rs.	a	p.	Rs.	a.	p.
1880-81	24,524	3	3	6,658	5	0	17,865	14	3
1881-82	29,164	12	8	9,292	13	3	19,871	15	5

In the receipts for 1881-82 has been included a sum of Rs. 2,355-12-6, the value of produce supplied free of cost to other Departments of Government.

51. The main subjects to which attention was paid were the following :—

(1) *The distribution of all kinds of seeds and garden products.*—The quantities sent out under each main head were :—

	1880-81.	1881-82.
Fruit trees and cuttings	7,183	7,783
Strawberry plants	42,225	54,100
Ornamental plants	8,115	10,350
Seeds of all kinds (packets)	11,990	15,198
Timber trees and agave	...	8,691
Total of all kinds ...	69,513	96,122

(2) *The cultivation of drugs for the Medical Department.*—Hyoscyamus, aconite, taraxicum, and kamaila, have already been successfully grown and prepared, while colocynth and many others are expected shortly to be added to the list.

(3) *The acclimatization of foreign flowers and vegetables, the improvement of indigenous varieties, and the introduction of new kinds of plants, trees and fodder grasses.*—Much activity has been shown in this branch of work; but it would be impossible to recapitulate the results, which have already been reported in detail, without exceeding the limits proper to this report.

(4) *The training of native gardners.*—A small measure of success has been attained in this and gardeners have been sent to Peshawar, Amritsar, and Calcutta; while there is a considerable staff of apprentices, some of whom, it is hoped, may soon be qualified to be of service in public gardens elsewhere.

(5) The maintenance of the gardens, herbarium, museum, and library, correspondence with scientific men and institutions, and the supply of useful information on scientific questions to Government.

52. Attached to the Saháranpur gardens, and under the same supervision, are two small hill gardens at Mussoorie and Chajuri. Complaints have long been made of their unsatisfactory condition ; and a scheme for removing them to a site between

Mussoorie and Rajpur, which has greater natural advantages and is more conveniently placed for purposes of supervision, has been sanctioned by Government.

53. The **Lucknow Horticultural Gardens** have throughout been in the sole charge of Mr. Ridley. Their cost for the past two years has been as follows :—

	Total expense.	Receipts.	Net cost
	Rs.	Rs. a. p.	Rs. a. p.
1880-81	14,075	10,565 14 3	3,509 1 9
1881-82	13,500	10,148 11 3	3,355 4 9

Rs. 486-1-0 on account of produce distributed gratis has been added to the receipts for 1881-82.

54. The objects for which these gardens are maintained are more exclusively practical than those aimed at Sahâranpur. Their main functions, in which they are very successful, are the distribution of improved varieties of all kinds of horticultural produce, and the introduction of new kinds, both of plants and of cultivation. Their cost is very small, and would have been still less but for the entire failure of the mango crop for two years running. As at Sahâranpur, a considerable number of apprentices are in training to supply the want of skilled gardeners elsewhere. Attached to the gardens are a small exotic plantation, in which a large number of varieties of imported trees are cultivated, and a large arboricultural nursery to supply the wants of neighbouring districts. Nothing could be better than the condition of the young trees, of which there are more than 100,000, in the nursery, but, probably on account of the cost of carriage, the demand for them has been very small, and it is doubtful whether the nursery should be maintained, at any rate, in its present dimensions. As annual flower show is held, whose cost exceeds its receipts by the moderate sum of Rs. 50, and much good is done by the competition and exchange of information to the gardeners who exhibit.

55. The connexion of Mr. Phillips with this Department ceased at the beginning of the year. There was formerly a small Government farm at Allahabad in his charge which has now been abandoned, and the sewage farm and Khusru Gardens have been handed over to the municipality. The accounts of the sewage farm were finally cleared up in October last. Mr. Phillips' pay has been budgetted for in this Department for the current year ; but as all practical connexion has come to an end, his pay bills are no longer submitted for countersignature. A small payment of Rs. 25 per mensem from the Arboricultural Fund is made him on account of the exotic nursery.

VIII.—SERICULTURE.

56. The history of this enterprise to the end of March, 1881, and its final transfer to Messrs. Lister and Co., were reported in my No. 2173A. of October 22nd, 1881. Since then Major Murray, who manages the concern on the part of the firm, has been actively pushing operations in the Song grant, in which he has now 50,000 seedling mulberries and four acres of cuttings. A canal for irrigation has been dug 4¾ miles long, and the firm hope to plant out 200 acres during these rains. The young trees are of both varieties, the *sinensis* and the *multicaulis*, and Major Murray believes that, provided the leaf be healthy, it is a matter of indifference which tree is planted. The expensive iron breeding-shed which had been imported from England has not proved a success, being too hot in summer and too cold in winter; and as soon as his mulberries are old enough to give a good supply of leaf, Major Murray proposes to move the greater part of the operations to his grant.

57. One of the principal drawbacks of Dehra itself as a centre for sericulture is the want of leaf. Of this there is only a very small supply beyond what is given by trees planted in avenues along the sides of the roads, and they are too few or too distant to be of much service. Last year half the silkworm seed put down by the firm had to be thrown away for want of food. This year only 12 ounces were put down, and

even then there was not enough leaf for night feeding, though the trees were stripped for three miles round. Moreover, the roadside trees, not being manured or tended, threaten to give a continually diminishing supply.

58. The first hatching of the univoltine worm was on February 3rd (which is rather too early a date, as the worms are liable to be stunted by the cold) and all the eggs hatched within a week. The last cocoon was cleaned on March 31st. The produce in green cocoons was 8 maunds 21 seers, or about the same amount as last year.

59. Cottage cultivation was not a success. The amount produced last year by villagers was 12 maunds 24 seers green. But they were paid Rs. 40 for a green maund. The same quantity in the Punjab commands Rs. 16, Rs. 20 or Rs. 24, according to quality. The price of a maund of dry silk in Calcutta may be taken at from Rs. 80 to Rs. 100, and it is equivalent to nearly three green maunds. It follows that to pay Rs. 40 for a maund of green silk must inevitably result in loss. As the Dehra silk is of medium quality, Major Murray this year offered Rs. 20 per maund for the produce. When he came to distribute the seed only two cultivators were found who would accede to the terms, and they took only 4 ounces of seed. Owing to want of cleanliness and limited accommodation their seed only produced about ten seers of silk to the ounce, or little more than a third of the result obtained by Major Murray.

No reeling is now done at Dehra. The best cocoons are reserved for seed; the rest are killed and sent to the branch in the Punjab, together with the pierced cocoons which have been left by the moths.

60. Major Murray is of opinion that Dehra offers a very fine field for the cultivation of healthy seed, and that if a remunerative price were guaranteed, an almost inexhaustible supply might be depended on. It becomes an important question whether the importation of healthy seed by Bengal silk-growers might not restore the decaying industry of that Province. The difficulty at present in way of providing such a supply lies in the fact that Messrs. Lister and Co. are at present the only silk-growers in the Dún, and they might not care to embark in an enterprise of that nature. They have been addressed on the subject, and their answer is expected. In order to enable them to make necessary arrangements, the amount required must be known before the end of February, or all cocoons that are not required by the firm itself for its own seed will be killed. For the next year Major Murray has been kind enough to promise that he will furnish Govervment with a small quantity sufficient for experiment.

61. A second silk concern has been started in the Dún by Colonel Utterson, but mulberry trees are not yet sufficiently advanced to admit of the growth of silk, and it cannot of course be depended on for seed.

62. The two great desiderata are mulberry trees and rearing accommodation. With regard to the first, the initial difficulty is that trees to be of any use must be within a short distance of the rearing-sheds. It hardly pays to carry them three miles, and certainly not farther. The land near Dehra is already taken up by crops and gardens, and is so extremely valuable that it is doubtful whether to plant it with mulberries, which might after all never be used, could be justified. To plant trees in the jungles is to anticipate on insufficient grounds the locality which a future silk enterprise might select. The Forest Department who were addressed with the view of establishing mulberry plantations, offered the sites of two deserted villages at a distance of about 24 miles from Naini Tal, and not nearer any other possible commercial centre. The cost would have been Rs. 7,000, and the trees would have been of no use whatever except for silk-rearing. Messrs. Lister and Co. informed me that such a plantation would be of no service to them, and as there was no reasonable prospect that any silk-grower would ever settle in the neighbourhood, the project was abandoned. It has subsequently been arranged with Mr. Church, the Superintendent of the Dún, that a small municipal garden at Dehra should be planted out with trees, and further

proposals are under the consideration of Government, which involve both the growth of mulberries and the provision of proper rearing-sheds for cottage cultivation.

IX.—TOBACCO FARM.

63. This used to be the subject of a separate report. In G. O. No. 1795 of 9th November, 1881, Government directed that it should be noticed instead in the annual Administration Report of the Department. Since the submission of the last report a lease has been executed by Government conveying the Farm at Ghâzipur to Messrs. Begg, Sutherland and Co. for 50 years, at an annual rent of Rs. 6,500, and with certain stipulations. In reply to an application for assistance in the shape of machinery to lift the water of the Ganges for the irrigation of their tobacco-fields the firm have been offered the use of the steam-engine which worked the plough at Bánda.

64. The total area under tobacco has risen from 404 acres last year to 482 in the year under report, and the produce from 270,000lb. to 326,000. It is a singular fact that the rate of produce per acre is almost exactly the same in both year—*i.e.*, 675lb. per acre.

65. The home cultivation covered 50 acres at Ghâzipur and 166 at Pusa, while the produce of 166 acres at Ghâzipur and 100 at Pusa was bought from independent cultivators.

66. Of the whole quantity produced 61,000lb. of cured tobacco were shipped to England and realized the high price of 5*d.* per pound—a result which, it is hoped, may encourage further shipments. 60,000lb. were manufactured into smoking tobacco for the Indian market and 10,000lb. were made up into cheroots and 800lb. into cigarettes. The prices realized in India were about 6 annas per pound for Cavendish and one rupee for smoking mixtures, and 8 annas for cheroots and 2 rupees for cigarettes.

67. The Farms employ five Europeans and Americans and a daily average of 401 natives. The price of native labor is much less than in the upper districts of these Provinces. The Manager of the Pusa branch reports that he pays from Rs. 3 to Rs. 3-12-0 per mensem for men, and from Rs. 2 to Rs. 3-4-0 for boys. Ploughs may be hired for 3 annas and carts for 5 annas per diem.

68. The firm propose to extend still further the area under cultivation for the ensuing year, and anticipate a still better rate of produce, and they confidently look forward to the season 1882-83 as promising to be the best since the commencement of the enterprize.

69. Forty-three copies of Mr. Buck's pamphlet on tobacco culture were sold during the year—a fact which points to the general interest taken in this important product.

X.—FAIRS AND AGRICULTURAL SHOWS.

70. *Batesar.*—The usual fair was held in the beginning of November and lasted for about ten days, before and after the great bathing festival, which fell on the 6th. The attendance was as follows :—

People	89,396
Horses and ponies	14,260
Camels	5,808
Cattle	35,307

The fair has been reported on by the Commissioner of Agra. The work of the Department was confined to the award of cattle prizes and the collection of information relating to the cattle-breeding and trade of that part of the Provinces. The labor of adjudging prizes to so vast a collection of beasts was simplified by preliminary selection. A number of tickets were printed off and the part of the fair occupied by the cattle divided into four quarters, of which Mr. Fuller, Thakur Umrao Singh, Munshi Ihsan Illahi, and myself each took one. We walked up and down the lines, and wherever we found an animal that seemed good enough, we gave his owner a

ticket, allowing him to compete for a prize. The number of competitors was thus reduced to manageable proportions ; even then the task of adjudging prizes took nearly a whole day. Sixty-four prizes of an aggregate value of Rs. 499 had been sanctioned, of which 48, of a value of Rs. 418, were awarded. Even in so large a fair, the small sum sanctioned was, I think, as much as was wanted. The classes which were best represented were cart and plough bullocks, and there were very few bulls or cows. With the view of encouraging the importation of fine bulls from the western tracts on the confines of the Panjab and Scindia's country, in both of which the breeds are excellent, it is proposed, in the ensuing fair, to publish the intention of Government to give good prizes for exhibits of this class, and to buy up for distribution elsewhere the best animals brought. A small number of bulls were bought at the last fair and taken to Lucknow, where they got the first class silver medal and two prizes, and were disposed of after much competition.

71. The information collected on the spot was compiled by Mr. Fuller in a short note, which appears to me to be of considerable value, and which I print here :—

" Mr. Aikman, C.S., who was in charge of the fair, informs me that the total number of cattle brought to the fair for sale was returned by the registration muharrirs as 35,000. It is probable, however, that this is considerably under the real figure, since the plain on which the fair is held is unguarded by any stream on the side towards Agra and Gwalior, and it is hardly possible that correct registration could be effected of the herds of cattle which entered it from this direction.

" The first impression gathered from a visit to the cattle lines was the enormous number of young stock brought by dealers from the tract known as Mewát (lying partly in the Muttra and Gurgaon districts and partly in the native state of Alwar), which, easily identified by the coloured lines and spots with which it is the fashion to decorate their coats, appeared to constitute at least 50 per cent. of the cattle at the fair. In order, however, to obtain some sort of statistical guide as to the class of cattle which are brought for sale and as to the character of the business which is transacted in them, both the Inspectors attached to this Department were employed in making enquiries from buyers and sellers in different parts of the fair, taking down in writing their answers and the questions put to them. These enquiries, supplemented by investigations made both by Director and myself, form the basis of the following statements :—

" The total number of *cattle-sellers* from whom enquiry was made was 321, 224 of whom were connected with land as zamindars or cultivators and 97 professional dealers. The number of cattle brought for sale by these men was 1,664, of which only 163 were exhibited by the persons who bred them ; the remainder (1,501) having changed hands previous to being brought to the fair.

" The *cattle-sellers* from whom enquiry was made belonged to ten districts. The number of cattle which came from each of these districts are shown below, classified according to their age :—

District	*No teeth (i. e., milk teeth only).*		*Teeth incomplete.*	*Teeth complete.*	*Total.*
	Number.	Per cent. on total.	Number.	Number.	Number.
Muttra	820	99	...	4	824
Aligarh	69	81	3	13	85
Agra	36	50	16	21	73
Gwalior and Bhind	8	3	78	172	258
Etáwah	6	6	26	66	98
Mainpuri	2	6	16	12	30
Etah	...	...	...	11	11
Farukhabad	...	...	2	11	13
Hissar and Hansi	266	100	...	...	266
Jhánsi	...	...	...	6	6
Total ...	...	...	...	...	1,664

" It is noticeable that no cattle appear from any district in the Meerut or Rohilkhand Division, except Aligarh, although, as will be shown below, very large purchases were made at the fair on account of both these Divisions.

72. " The table shows very clearly (1) that the districts which contribute largest to the fair are Muttra, Gwalior, Etáwah, and Hissar ; (2) that the ten districts may be broadly divided into two classes, according as the cattle which they send consist chiefly of young or of mature stock, the first class comprising only Muttra, Aligarh, and Hissar, while the other districts all fall with more or less completeness under the second class. This is explained by the fact, which was established beyond a doubt by our investigation, that perhaps the largest portion of the business transacted in cattle at the fair consists in the purchase of Mewáti or Hissar calves by zamindars or cultivators of the Agra, Etáwah and Mainpuri districts, or belonging to the Gwalior State, for the purpose of grazing them on the raviny lands, in which this tract abounds, and of selling them after three or four years at a profit. As a fact, in support of this I may note, that 149 out of the full-grown cattle sold by zamindars or cultivators were disposed of with the express object of purchasing calves to take their place. It is certain that young stock formed almost the whole of the cattle brought from Mewat and Hissar, and that they constituted but a very small proportion of the cattle from the country east of Agra ; and it appears therefore that Mewat and Hissar are the breeding-grounds from which the fair is supplied, the Jumna tract east of Agra being principally used for merely grazing purposes, and what breeding is carried on there being apparently unable to do more than satisfy local requirements.

73. " It is further to be noted that the proportion of cattle exhibited by breeders is extremely small, and the trade is practically in the hands of middlemen, whether styled zamindars or cultivators, or whether professed dealers, of whom Mewáti Musalmans are the chief. This is shown below :—

District.	Brought by breeders.		Brought by middlemen.				Grand total number.
	Number.	Per cent. on total.	*Zamindars or cultivators.*	*Dealers.*	*Total.*		
			Number.	Number.	Number.	Per cent. on total.	
Muttra	...	...	...	824	824	100	824
Aligarh	...	...	14	71	85	100	85
Agra	6	8	38	29	67	92	73
Gwalior and Bhind ...	118	45	133	7	140	55	258
Etáwah	34	34	64	...	64	66	98
Mainpuri	2	6	28	...	28	94	30
Etah	...	...	11	...	11	100	11
Farukhabad	2	15	11	...	11	85	13
Hissar and Hansi ...	...	...	...	266	266	100	266
Jhánsi	1	17	5	...	5	83	6

" All the young cattle from Mewat and Hissar are shown to be brought by professional dealers ; and indeed the only tracts from which breeders appear to exhibit are Etáwah and the Gwalior State, and the cattle brought by these men are, as has been shown above, principally full grown.

74. " In addition to the above notes collected concerning cattle exposed for sale, some information was obtained relative to destination of cattle which had been already purchased in the fair. The number of purchased cattle concerning which enquiry was made was 797, of which 316 were purchased by zamindars and cultivators and 481 by dealers. Cattle were purchased for all the districts mentioned in the preceding tables, with the notable exceptions of Muttra and Hissar, and, in addition, for the districts of Muzaffarnagar, Meerut, Bijnor, and Bareilly. The

cattle purchased for each district are shown below, being classified according to ages :—

District.	No teeth i.e., only milk teeth.		Teeth incomplete	Teeth complete.	Total.
	Number.	Per cent. on total.	Number.	Number.	Number.
Muttra	...	...	...	...	...
Aligarh	...	...	...	34	34
Agra	14	100	...	...	14
Gwalior and Bhind	136	100	...	...	136
Etáwah	104	56	...	80	184
Mainpuri	36	100	...	...	36
Etah	5	100	...	...	5
Farukhabad, ...	...	...	18	...	18
Hissar and Hansi	...	...	...	...	...
Jhánsi	3	100	...	...	3
Muzaffarnagar	...	...	7	187	194
Meerut	...	...	...	92	92
Bijnor	..	...	...	48	48
Bareilly	..	...	...	33	33

"We find therefore different districts distinguished by differences in the age of the cattle purchased by them. The Jumna ravine tract east of Agra purchases principally young stock, which is probably destined for sale again after having been grazed for three or four years. The districts of the Meerut and Rohilkhand Divisions, on the other hand, confine their purchases to full-grown cattle for employment in well-irrigation and sugar-pressing. The whole of these purchases are made by a class of Mewáti dealers resident as a rule in the districts for which they purchase and quite distinct from the Mewátis of Mewat proper, whose trade lies principally with young stock fresh from the breeding-grounds."

75. "The most characteristic features therefore in the business transacted at the fair are—(1) the import of young stock by dealers from the breeding-grounds in the tract comprising portions of the Muttra and Gurgaon districts and known as Mewat. (2) The purchase of this young stock by zamindars and cultivators of the Jumna ravine tract east of Agra, who graze them for two or three years and then bring them back to the fair for sale. (3) The purchase of these full-grown cattle (together with others imported by local dealers from breeding-grounds in Bhind and Gwalior) for agricultural purposes in the Meerut and Rohilkhand Divisions."

76. The following agricultural shows were held during the year in the chronological order in which they are noticed :—

At *Fyzabad*, in the beginning of November, under the management of the Deputy Commissioner, Mr. Woodburn. The time was judiciously chosen, as it coincided with the great concourse of pilgrims to the autumn bathings at Ajudhya ; and it has been proposed that a similar advantage should be taken of the November fair at Dalmau. The best of the farm apprentices was deputed to exhibit the departmental pump and plough and American maize huller and the winnowing machine. The plough took the first prize in the ploughing match ; and it was reported that if more had been sent, there would have been many purchasers. The whole fair was very successful and threw much light on the conditions under which such gatherings should be held.

77. *Lucknow.*—The Talukdars of Oudh, under the presidency of the late Maharaja Sir Dirgbije Singh of Balrampur, in whom the cause of agricultural improvement in the Provinces has lost an enlightened friend, held a large agricultural meeting at Lucknow in the last few days of 1881 and the first of 1882. Major Newbery acted as Secretary to the committee ; and Mr. Fuller was deputed in December to afford such help as he could. The proceedings have already been reported at length. There were four main sections—those of cattle, agricultural implements, agricultural

produce, and arts and manufactures, the last of which was helped by a fine loan collection contributed by the nobles and princes of Oudh. For each section there was a separate judging committee, and with the exception of cattle the exhibits in all were both numerous and of good quality. Densely attended meetings were held on three mornings in the committee-room at Canning College, and questions affecting the agricultural future of the Province were discussed with freedom and intelligence. In a report on the working of the Department it would be out of place to go beyond the part it took in the proceedings, though there were matters of much greater general importance and interest. A large collection of agricultural implements was sent from Cawnpore and exhibited at work by one of the farm apprentices. A considerable contribution was made to the exhibition of agricultural produce from the same source. Mr. Fuller sat on the judging committee for agricultural produce, and Mr. Wilson on that for implements, and wrote the reports of their respective, committees. The following prizes were awarded to the departmental exhibits :—

1st prize (silver medal and Rs. 15, to the Kaisar plough. It is fair to say that Mr. Crawley with the "Nawab," Mr. Gavin Jones with the "Ryot," and Messrs. Coen and Co. with the "Pioneer" ploughs were each only one mark behind, and that these implements are probably but little inferior in practical utility.

1st class silver medal for the best water-lift worked by manual labor.

1st class medal for the best water-lift worked by bullock power.

1st prize for soft white wheat. This was the wheat which had been introduced from Muzaffarnagar on the Cawnpore Farm and gave such an excellent crop at the last spring harvest. Its superiority to local varieties was very striking, and it was at once picked out as the best by the native grain-dealers who assisted the committee.

2nd prize for maize. This was the variety that had been introduced from Jaunpur.

1st prize for cotton.

A special prize for general excellence of exhibits in the section agricultural products.

1st class silver medal and two prizes for bulls brought from Batesar.

78. *Gonda* (18*th*-21*st January*, 1882).—This was the first held in this district. The initiative was taken by Major Forbes, the Deputy Commissioner, and the details arranged and carried out by a committee of native gentlemen. A large tent was used as a committee room, in which agricultural subjects were debated, and in other respects its main lines resembled those of the Lucknow exhibitions. The grain exhibits were very good, and the cattle both more numerous and of a better quality than they had been at Lucknow. A novel and very excellent feature was the distribution of handsome prizes for the best patwáris' papers exhibited.

79. During the months of February and March four agricultural exhibitions were held in the Meerut Division, at Bulandshahr, Aligarh, Nauchandi near Meerut, and Sahárnpur.

My unavoidable absence in other parts of the Province prevented me, very much to my regret, from attending any of these. Reports from all have already been submitted to Government. There is no part of the Provinces where they are more likely to have a good effect. The cultivators are distinguished for their intelligence, wealth, and readiness to adopt new ideas ; and the officers of the Division have always shown an exceptional interest in agricultural progress.

80. Besides the meetings held in the cold weather, there have been for the last two years important shows at the Sayyid Salar Mela at Bahraich in May. The first of these took place before my connexion with the Department, and was attended by

Mr. Fuller, who then officiated as Director. The Department contributed exhibits of wheat, maize, and cotton, and the following improved agricultural implements : —

Four kinds of plough.	The farm water-lift.
The farm winnower.	A Bihia sugar-mill.

One of the more important results of this show has been the establishment of a periodical cattle fair at Bahraich. The last show at Bahraich is subsequent to the year under report, and notice of it must be deferred.

82. The connexion of the Department with shows usually takes the form of advice as to the classification of exhibits for prizes, the selection and appraisement of points for marking and similar subjects, on which a certain amount of information has been accumulated from attendance at numerous shows. It might, and to some extent does, act as a focus for the collection and distribution of the experience gained by officers in all parts of the Province. The exhibition of improved machinery is a new and not unimportant duty which taxes its present resources rather severely.

XI.—CAWNPORE EXPERIMENTAL FARM.

Three harvests have been reaped since the submission of the last Administration Report, *i.e.*, the spring crops of 1881 and 1882 and the autumn crops of 1881. During the first few months of this period the farm was under the superintendence of Mr. Crawley; but his work proved unsatisfactory, and he was dismissed by Mr. Fuller shortly before I took over the charge of the Department. From August till December, 1881, the farm was in the sole charge of Mr. Fuller; and in December it was entrusted to Mr. Spitteler, who worked it under Mr. Fuller's direct management till the close of the official year. Agricultural experiments require not only a certain amount of scientific knowledge for their conduct, but owing to the fact that they are extended over several months, and are liable to be vitiated by the carelessness or dishonesty of the servants immediately employed on them, an untiring vigilance, which is seen more rare than scientific knowledge. Unless the results are absolutely trustworthy, their publication misleads both the State and the cultivator on matters of great practical importance and is in the highest degree pernicious. Mr. Fuller fortunately combined both the qualities which are required for the successful prosecution of the work, and complete dependence may be placed on the accuracy of the facts which he reports.

83. Properly-conducted agricultural experiments serve two purposes : they ascertain the direction which improvement should take, and make Government acquainted with the actual conditions and results of existing cultivation. Such irreconcileable differences of opinion exist on the latter point that much value attaches to the weight of the crops obtained on the farm. In the spring of 1881, the average weight of wheat grain obtained on nine plots under various kinds and quantities of manure was 1,236lb., or more than 20 bushels per acre; while barley on unmanured land, which had been ploughed early, yielded 1,840lb. of grain and on heavily-manured land 3,603lb. The land from which the wheat had been reaped was sown with maize for the ensuing autumn harvest, and where unmanured gave an outturn of 1,239lb., making with the wheat of the previous harvest a total produce of 1,946lb. per acre in the year, though neither crop had been manured; where poudrette was used, the total produce of both crops, wheat and maize, reached 3,342lb., or nearly 63 bushels to the acre. In the crop cut last March, the outturn of wheat averaged 1,590lb. on the whole area sown (16·8 acres), and on one unmanured plot reached 2,662lb.; common gram without manure gave 1,932lb., and cotton, an average of 161·8lb. of clean fibre to the acre, the assumed provincial average of the latter crops having been 66lb. in the same year. The natural quality of the farm land is very poor, especially in nitrates. The instances in which unusually heavy manure was given were rare and hardly affected the general results. The only advantage not enjoyed by the ordinary native cultivator was the use of the soil-inverting plough, and against this should be set unsuccessful experiments with manures and a perhaps unusua amount of double

cropping. The chief lesson taught by the repeated experience of every harvest is that the great want of Indian agriculture is nitrogen. Without recapitulating the numerous experiments that were made, it may be said that whereas the results from the application of lime, phosphates, or potash were conflicting, and sometimes positively injurious, the benefit from the use of nitrates was throughout great and certain. The results obtained by experiment were confirmed by scientific analysis of the farm soil, which showed that whereas it contained the normal quantity of other valuable elements, its supply of nitrogen was only a fourth of that contained in typically fertile soils in Europe. Of the various ways in which this want may be supplied, the simplest is that of early ploughing, which certainly enables the land to absorb the maximum of ammonia from the rain, and probably admits of considerable nitrification from the atmosphere during the hot weeks that precede it. The amount of ammonia with which rain-water is charged and the effect of the hot atmosphere in nitrifying the land are both subjects on which accurate information is much wanted, as an intelligent view of the conditions of Indian agriculture is impossible without it.

84. Another simple and very efficient method of supplying nitrogen was found in green soiling—that is ploughing in any leguminous crops. The first tried was indigo, but hemp was subsequently used as cheaper and equally effective. The expense is trifling, being merely the value of the seed and the cost of a single ploughing. The increase in grain obtained was 73 per cent. in the spring of 1881, and in 1882, 33 per cent. without, and 74 per cent. with, the addition of 120lb. of gypsum the acre. As yet no counterbalancing disadvantages have been discovered.

Among ordinary manures, the importance of all kinds of excreta, and probably saltpetre, was strongly emphasized.

85. The advantages of deep ploughing have been so far accepted that it is now the only form of cultivation in use on the farm. A single experiment with the country plough was made in the rabi of 1880-81, but the soil of that particular plot had been so much exhausted by previous over-cropping that the result taught nothing. Defective conditions in an experiment tried in the next autumn led to a similar failure; and the excellence of the crops obtained by deep plouging rendered any further trials with the country plough superfluous.

86. Experiments with canal and well water gave a slight advantage to the latter, which may perhaps be accounted for by the greater opportuneness with which the cultivator can apply it. It was shown that a single watering increased the value of the produce by more than Rs. 33 per acre, while in two separate series of plots the unexpected result was noted, that while every watering from the third to the fifth increased the outturn, land that had been watered only twice produced rather less than land that had been watered once. The explanation seems to be that the land had not been opened up by weeding after the second application of water, and the surface had caked.

87. Sowings of wheat at differing distances seemed to show that with proper care a reduction in the quantity of seed might be made without any corresponding reduction in the rate of outturn, and that a cheap drill might therefore be introduced with profit to native agriculture. A rude attempt to construct an appropriate implement has been made, but further development is required.

88. A number of new staples have been tried, of which the most promising are Georgian cotton and Cape oats. The former, though not giving so large a yield as the indigenous Kulpahar on inferior soil, easily distanced it on heavy land ; and a field which has been left over from last year now gives the promise of a magnificent second harvest. Its cotton commanded Rs 25 per maund in the Cawnpore market at a time when native varieties were being sold at Rs. 18 : so that with a smaller outturn it might prove a more profitable crop. A very small packet of Cape oats was received two years ago and yielded the large rate of outturn of 2,334lb. per acre to the first and 1,640 to the second time that it was sown. About a maund of seed has been

procured, which will be reserved for future sowings. The wheat and maize sown on the farm were generally the native varieties, which have attained so high a degree of merit at Meerut and Jaunpur respectively ; and the success which has attended their introduction at Cawnpore shows what may be effected by a judicious selection of country seed.

XII.—WORKSHOPS.

89. **Agricultural implements.**—The work shops are attached to the farm, and except for a few months in the last cold weather, when they were transferred to Captain Clibborn, have been like it in the sole charge of Mr. Fuller. The form of the improved plough received its latest development a little more than a year ago, when a long beam was substituted for the short beam, which had been adopted from its American models. The short beam was not adapted to native habits and had no real advantage beyond a slightly increased facility in turning the corner at the end of a furrow, so that the alteration has certainly increased the popularity of the implement without seriously detracting from its utility. During the rabi season of 1880-81, 86 ploughs were disposed of, of which 44 were of the new pattern. During the year under report 393 have been distributed, and the demand for them shows signs of increasing. The province of the Department ought to be bounded by the determination of the form of implement it might be desirable to introduce. It can hardly undertake manufacture on a large scale. Attempts were made to transfer the construction of both ploughs and chain water-lifts to private firms during the year, but without any great measure of success. At present a native agent, who had been employed by Messrs. Mylne, Thomson and Co., to introduce their sugar-mill, is travelling with the Kaisar plough, and has succeeded in obtaining a number of orders, which makes it probable that an extension of the same form of agency might be adopted with advantage. Though the Kaisar plough seems to be admirably adapted for light soils, such as are the rule in the greater part of these Provinces, complaints have been received from the Meerut Division that for certain forms of cultivation a heavier implement is required. The want appears to be met by slight modifications of Ransome's B. F. O. or Watts' steel plough, both of which can be obtained at the workshops.

90. The form of the water-lift was decided on early last year and 46 have been sold. Even now it cannot be said to be final. It was at first thought that 20 feet would be the limit at which it would work efficiently ; but it has since been found that by slightly reducing the diameter of the tube, water may be lifted in amply sufficient quantities from a depth of at least 30 feet and probably more. The present plugs and their attachments to the chain are not wholly satisfactory, being rather liable to get out of order. Experiments are now being made with the view of inventing a plug which will fit the tube without wearing out, and a method of attachment which will be secure without weakening the chain.

91. The winnower mentioned in last year's report has been repeatedly tried, both against the native method and English machinery. Though less effective than the former in a high wind, it got much better results in a calm, and held its own with the imported machinery. As however at the time when a winnower is wanted there is generally a prevalence of high wind, and the natives have at the same time very little other employment, it does not appear that the machine is likely to come into general demand. Only a very few have been sold.

92. A wind-mill (the Kewani) was subjected to the most careful and elaborate trials and unhesitatingly condemned. It has no advantages over the modes of lifting water now known in the country, and is liable to be carried away by dust-storms. A combined threshing and winnowing machine manufactured by Messrs. Heebner and Sons of the United States gave excellent results, but it is doubtful whether it can do enough work to cover its original cost. It is however probably worth further trial.

93. Some interesting experiments in sugar-boiling were made by Mr. Spitteler while he was in charge of the farm. His chief innovations on the native system were that he used copper pans instead of iron, and only two instead of four, placing,

the fire under the first or largest pan, which receives the raw juice, instead of at the other end of the row under the smallest pan, where the condensation is completed. He also tried several defecating substances, such as freshly-burnt lime, *sajji matti* (impure carbonate of soda), and sap from the stalks of the *bhindi* plant. Two qualities of *gurh* were made and sent to the Cawnpore market, where they were sold at 11½ and 11 seers for the rupee at a time when the best native-made *gurhs* of the corresponding kinds were being sold at 12½ and 11½ seers respectively.

XIII.—NATIVE ZAMINDARS AND COURT OF WARDS.

94. The Department has a considerable correspondence with native agriculturists, not only in this Province, but over the greater part of India. It generally consists of questions and answers on isolated points of agriculture, and no adequate account could be given of it that would not be insufferably tedious.

It has invited a number of the leading native gentry to communicate short reports on any experiments in improved husbandry that they may undertake, but the answers have not as yet been many. Its most regular correspondents have been Pandit Ajudhiya Parshad of Indulpur, Raja Shambhu Narayan Singh of Benares, and the Bijnor Agricultural Society.

95. Pandit Ajudhiya Parshad's first report, which was received last autumn, was communicated to the *Indian Agriculturist.* Another interesting communication has been received lately. He has tried a very large number of new seeds, such as American and Jaunpur maize, English and native carrots, onions, turnips, mangold-wurzel, Chaffa (ground-nut), Reana, American and Egyptian cotton, American tobacco, sorgham, and in fact any seed which the Department could supply. He has had, as might have been expected, a few successes and a large number of failures. Meerut wheat, sorgham, American cotton, mangold-wurzel, and Guinea-grass are the staples which seem to have the fairest prospect of success ; but the result has not been very encouraging, and experiments of the kind are likely to be found somewhat expensive to a man whose means are limited. He has found during the last cold weather a more certain source of profit from a combination of the use of the Bihia mill with a new method of dealing with the sugar-grower. Instead of buying the expressed juice from the cultivator, as is the prevailing custom in Rohilkhand, he makes arrangements with him for the purchase of the cane itself and conducts all the operations which succeed the cutting and carrying of the crop at his own risk. He reports tha tthe return on his outlay has this year been more than 20 per cent., and proposes next year to extend his operations. He is now in consultation with the Department as to how the boiling-vats might be improved, those now in use in his neighbourhood being both dear and wasteful.

He has tried the Kaisar plough for barley, and reports a produce from deep-ploughed land fourfold as great as what was obtained from the same area and seed by the country plough. He has raised ten calves by a Bánda bull supplied him by the Department ; and an Arab donkey stallion had fertilized a few country ponies, but he finds the villagers generally averse to breeding mules.

96. Raja Shambhu Narayan Singh of Benares reported some interesting experiments in bone-dust and cattle urine preserved for manure. He has found that the Kaisar plough increases the produce of sugarcane, and has this year engaged to spend a large sum in sinking wells, provided that the Department will furnish him with engineering advice.

97. The Maharaja of Balrampur deputed one of his servants to live at the Experimental Farm and acquire such instruction as was to be gained by an inspection of the kharif operations.

98. The Bijnor Agricultural Society was founded by Raja Jagat Singh of Tajpur. It takes a very intelligent interest in all problems connected with improved agriculture

and, besides being a constant correspondent, sends in periodical printed reports of its operations. Its measures are being systematised by Pandit Shri Lal, its Secretary, and it proposes to hold an agricultural show in December next. Kunwar Harnam Singh Ahluwalia, who manages the estates of his nephew, the Raja of Kapurthala, has sent in an interesting report. He held a cattle show at Bundi on the occasion of the Dasahra festival in October, and distributed prizes for the best exhibits. A report is promised of any results from a small experimental farm which has been started. Five small arboricultural nurseries have been made to supply trees to plant round the irrigation wells on the estate, and cultivators are encouraged to plant groves and roadside avenues. The terms in the case of groves are that the land allotted, which is usually banjar, shall be held free of rent after the payment of the complimentary *nazar* of one rupee. The fruit of the grove is to remain the property of the planter and his direct descendants, but collaterals are to have no claim; nor the planter or his descendants, if they leave the village. The estate takes the dead wood and the grass, after having left the latter to the cultivator for the first ten years after the grove has been planted. The cultivator has no right of sale. Waste strips along the edge of roads are divided into lots and given out to cultivators to plant. The estate reserves a general right to take wood for its own requirements, and one-fourth of the value of any trees are felled and sold. Subject to this, the trees are the property of the planter.

XIV.—COURT OF WARDS.

99. **Court of Wards' Estates**—*Karm Ali Khan's Estate, Meerut.*—A large variety of imported seeds were sent to this estate, but they cannot be said to have been successful. The Collector frankly ascribes this to ignorance of agriculture on the part of his manager. Bone-dust manure was tried, but without result. Two Kaisar ploughs and some improved sieves were sent and both were highly appreciated. Six Bihia sugar-mills were bought and are let out to the cultivators on the estate. The receipts during the year for their hire amount to Rs. 186-6-0, or more than 30 per cent. on the original outlay. Two wells have been built and two more are in course of construction. It was reported that reh was spreading in some of the villages, and Mr. Wilson was deputed to examine the phenomenon on the spot. He sent in a note, which has been submitted to the Board. A copy was forwarded to the Collector, who can hardly fail to find its eminently practical suggestions of use to the estate. A Persian wheel has been set up, but does not appear to command the approval of the cultivators.

100. *Dubari.*—Mr. Wyer conducted experiments with the Kaisar plough and reports favourably on the results. His only successes with imported seeds have been with mangold-wurzel and carrots. The Cawnpore pump was found unable to hold its own with the native *dhenkli*, water being very near surface; but I may venture to suspect that some allowance must be made for want of familiarity with the improved water-lift. A half-bred Australian ram was supplied by the Department to improve a once famous, but now degenerate, race of sheep. Some experiments were made with the object of preserving cattle urine for manure and promised good results. A new kind of well with a water-tight bottom and fed by percolation through dry laid bricks was found both cheap and effective, and has been adopted by Raja Jagat Singh of Tajpur with the same satisfactory results.

101. *Kantit.*—Experiments with the Kaisar plough were set on foot, but had to be discontinued in consequence of the want of interest displayed by the local officers.

102. *Awa.*—Mr. Crooke reports unfavourably of the Kaisar plough. He found that the soil a few inches below the surface was an unproductive clay known as *kapsa*, and that to turn that up ruined the fertility of the field. But this is a phenomenon of rare occurrence, and the scene of the experiments was unfortunately chosen. At the same time his report has the value of calling attention to the undoubted fact that deep ploughing, however advantageous it may generally be, is fatal where there is an unfertile sub-soil near the surface, and should not be blindly adopted everywhere.

In implements the only marked success has been with the Bihia sugar-mill, of which the estate management now has 36 in work, either on the home farm or lent out to cultivators, and has indented for 25 more.

Mr. Crooke's home farm has been so far a success that he has cleared a profit of Rs. 4 per acre in the year instead of suffering the positive loss which frequently attends experiments. Little progress was made with new staples; and indeed little can be expected till trustworthy men with a practical knowledge of agriculture can be found to take charge of the *sír* lands of the estate. During the last year I received several applications from Collectors for men of this stamp, but they are not now to be obtained. If the project of establishing a school of practical agriculture in connexion with the Cawnpore Farm is realized, there is some hope that the demand may be met. At present a knowledge of the traditional methods of cultivation and the intelligence that will accept useful modifications of them are not to be found in the same man.

Mr. Crooke has met with more success in the manufacture of undrained sugar. He has imported a professional sugar-boiler from Bihia, and the admirable *gurh* exhibited at Lucknow gained him the first prize in open competition.

He maintains a large and promising breeding establishment, and his stock comprises horned cattle, buffaloes, sheep, and an Arab donkey stallion. This is a subject which he took up, in conjunction with the Department, on his first assuming charge of the estate, and there is every reason to believe that his efforts will improve the breeds of the neighbourhood. Two young men have been sent to learn veterinary surgery at the Hápur Stud Farm.

His very important operations in connexion with the reclamation of usar and the construction of a large number of wells for the cultivators on his estate have been in the charge of Mr. Wilson, whose services were placed at his disposal by the Department.

103. *Rawatpur* enjoys the advantages of close proximity to the Cawnpore Experimental Farm and a very intelligent manager, Lala Indarjit. The Kaisar plough has been largely adopted. Three are in every-day use on the *sír*, and 37 more by the ordinary cultivators on the estate. Two Bihia mills have been bought and more will be sent for. The sugar cultivation has in consequence spread from two to eight villages. Trials with new seeds have met with some success. In spite of the fact that nearly a third of the crop was eaten by caterpillars, New Orleans cotton sown on 2¼ acres gave an outturn in December of 145lb. of clean fibre to the acre, and being allowed to stand, gave a second crop in April of 25lb. of clean cotton to the acre. This was sold to the Muir Mills for Rs. 25 the maund at a time when country cotton only commanded Rs. 18. The same high price was obtained for Nankin and Upper Georgian cottons; but the specific produce, though not very low, was not sufficiently encouraging to warrant further trials, Jaunpur maize yielded 12, Muzaffarnagar wheat 16, and Cape oats 24 maunds to the acre The latter crop was obtained by manuring with calcic superphosphate manufactured by Lala Indarjit himself from powdered bone-dust; but though the yield was high, the cost of making the manure was perhaps higher. For the ensuing year the manager has sown 3½, and ordinary cultivators 20 acres with New Orleans cotton; 4 acres have been sown with Jaunpur maize, and 2½ with hemp, to be ploughed in as a manure for wheat; the latter an experiment new to the estate, but which has given excellent results on the Government farm. Two new wells have been constructed for four buckets each and give an ample supply of water.

104. In September last a circular was issued to Court of Wards' estates and native correspondents of the Department, asking them to send in annually some notice of any points of interest in connexion with the agricultural operations on their estates. It was proposed to excerpt such communications as might prove of public interest and publish them. Extracts from the more interesting reports received from native gentlemen are printed in the appendix.

XV.– MISCELLANEOUS.

105. **Distribution of seed.**—The Department has a permanent imprest of Rs. 2,000 to enable it to purchase select varieties of seeds for distribution. The prices realized are repaid into the treasury to the credit of the imprest.

The following kinds and amounts of seed were distributed during the year :—

		Mds.	s.	c.
Cotton ...	Hinganghát	1	0	0
	Kulpahar	1	33	0
	New Orleans	1	2	8
	Cawnpore	1	0	0
	Meerut	1	0	0
	Upland Georgian	0	20	0
	Bamich	0	2	0
	Tree cotton	0	18	0
Maize ...	Jaunpur	6	0	0
	American	0	21	8
Sorgho		2	9	0
Lucerne		0	32	12
Guinea-grass		0	4	12
Tobacco		0	5	12
Ground-nut		1	18	0
Carrots		1	30	0
Mangold		1	18	0
Reana		0	0	4
Cape oats		0	5	0
Muzaffarnagar wheat		653	6	0

These were sent, generally in small quantities for experimental purposes, to 75 different customers, the largest class being that of native gentlemen in the Provinces.

106. The soft white wheat of Muzaffarnagar had proved so great a success, both as to quantity and quality, at the Cawnpore Farm that it was thought worth while to make an effort to secure its greater diffusion. A special officer was therefore deputed to buy it up on the spot, and considerable quantities were sent to Cawnpore. Unfortunately a great proportion of it had been injured by weevil, and on this account only unfavourable reports were received. As a general rule it appears to have been fairly successful. Twenty-five maunds of it were sent for trial in Australia, where this variety has been much admired. The question of seed distribution is one of equal importance and difficulty. On the one hand there can be no doubt of the great value of new seed to supply a failing strain, even though the original quality may not be much superior ; and the advantage of buying seed at the places where it is strongest for sowing in districts where it is liable to degeneration is showed by such cases as that of the Bengal indigo-planters, who import the greater part of their seed from Northern India. On the other, the difference of price between good and poor varieties of grain is not sufficient to compensate for a largely diminished yield per acre, and new seed is liable to be less productive in its first year under unaccustomed conditions.

107. Through the kind assistance of General Sir H. Ramsay we were able to send 106 maunds 26 seers of hill potato seed for distribution in the plains. Great promptitude is required in this matter, as the hill seed ripens at about the same time as when it is required for sowing, and if detained on the road is too late to be of any use.

108. **Steam plough.**—This reached Bánda in January, 1881, its difficult journey from Allahabad with the Jumna crossing on the way having reflected the greatest credit on the skill and energy of Mr. List, the Engineer in charge, and an account of the opertions till then is given in last year's Administration Report. Up to March 31st, 1881, it had been worked for 44 days and ploughed altogether 275 acres, of which 96 were by the cultivator in 12 days and 176 by the special plough in 32 days. In April it was worked for 13 days, doing 121 acres, and was then transferred from the village of Pachnehi, where a scarcity of water prevented further operations, to Bánda. After the rains it was sent to another village, Tari, and by the end of December, 1881

had ploughed 454 acres, the cultivator being generally used. The whole area ploughed from January to December was therefore 847 acres, but the plough was some little time in getting to work: accidents, which a little more experience would haveavoided, interrupted it, and there can be no doubt whatever of its being able to plough at least 1,200 acres during the year.

The cost was as follows :—

	Rs.	
Establishment	172	per month.
Water	84	"
Oil and tallow	25	"
Wood	234	"
	515	"

or Rs. 6,000 per annum, allowing enough for repairs and contingencies, and deducting working expenses for the months when it cannot be used. If coal is used for fuel it would cost Rs. 600 per month, and raise the annual expense of maintenance to Rs. 9,000. The total cost then of ploughing, without making any charge for interest on the original outlay, would be Rs. 5 per acre if wood, and Rs. 7-8-0 if coal were used. The areas sown and the realizations were—

For kharif—	B	b.
Sír	56	0
On grain rents	32	10
	88	10

on which the net receipts were Rs. 193-14-0.

For rabi—	B.	b.
Sír	56	0
On grain rents	45	10
On cash rents	743	0
	844	10

on which the net receipts were Rs. 1,921. The total receipts therefore were Rs. 2,014-14-0 on an area of 905 bighas, or Rs 2¼ per bigha—say Rs. 5 per acre.

109. On 10th January, 1882 Mr. Fuller and Mr. List met the Collector at Bánda to discuss the future of the plough. As the result of their conference Mr. LaTouche sent in a report to the effect that—

(1) There was no more Government land to plough.

(2) That the plough must in future work in zamindari land.

(3) That the zamindars were not willing to pay more for the steam plough than what would be paid for an ordinary plough ; that only one, Chundi Singh, had come forward with an offer of Rs. 3-4-0 per acre, and that even he showed no anxiety to have his offer taken.

(4) That the supply of wood at Bánda had been exhausted and in future coal must be used, with the effect of raising the expenses 50 per cent.

(5) That the káns grass, for the eradication of which the plough had been imported, had spontaneously disappeared, and that one of the main uses of the implement had therefore ceased to exist.

He proposed to send it to Karwi, where there was an estate with large waste areas under Government management ; but insuperable obstacles were found to this scheme, and finally Government ordered that the plough should be sent to Cawnpore. The crossing of the Jumna being very dangerous in the hot weather, when the river is low, and the plough would have to descend and mount steep banks, it was decided to postpone the operation until after the rains. It is possible that the engines may be employed to pump water from the Ganges for irrigation in connexion with the tobacco farm at Gházipur.

110. **Kumaun Orchard.**—An apple orchard is maintained at Muktesar, near Almorah, by General Sir H. Ramsay at the expense of the Department, with the object of providing the neighbouring villages and European settlers with good fruit trees.

During the past year good progress has been made in spite of the unusual drought; 1,021 apple grafts and 243 chesnut trees were given away. The villagers have applied for many more trees, and as the small gardens already started succeed the demand is nearly certain to increase. The present stock consists of—

Apple grafts	5,629
Grafted pears	266
Chestnut trees	434
Apple seedlings	10,000

of which more than half will be ready for grafting next spring.

Last year's crop of potatoes was excellent. About 200 maunds were sent to Assam and Burma, and large quantities were distributed both in the hill and plains districts of these Provinces.

111. **Calcutta Exhibition.**—The sum of Rs. 1,000 was sanctioned by Government to enable the Department to contribute specimens of the art manufactures of these Provinces to the Fine Art Exhibition which was held at Calcutta in January last. The value of the goods exhibited by the Department was Rs. 5,683, of which Rs. 562 was the property of the Department, while it acted as medium and paid the railway expenses on the remainder. The total charge for freight was Rs. 117-3-6, and goods to the value of Rs. 134 were returned. Of the total sum sanctioned Rs. 726-9-0 were repaid to Government. The goods exhibited were :—

Moradabad metal ware.
Lucknow lace.
Jhánsi carpets.
Benares brass ware.
Ditto kincobs and embroidery.
Mirzapur lacquer work.
Ditto carpets, jail made.
Ditto ditto, bazar made,
Lucknow bidri and zarbuland work.

112. **Sydney Exhibition.**—The accounts for this have been finally wound up, a few outstanding items having been transferred to the Melbourne account, which has also been now finally adjusted. The exhibits, which were collected by Mr. Buck and forwarded through Mr. O'Connor, Assistant Secretary to the Government of India, consisted of—

Cotton fabrics	Muir Mills. Elgin Mills.
Shawls	Cashmere. Amritsar. Rampur.
Gambroons	Ludhiana.
Satin	Azamgarh.
Carpets (jail)	Mirzapur. Jhánsi. Agra.
Arts ware	Moradabad metal. Benares brass. Agra mosaics.
Tea	Arakan. Kumaun.
Sugar	Rosa Factory.
Gurh	Bihia.

Two bronze medals and five diplomas were gained by the Department, one bronze medal and two diplomas by the Muir Cotton Mills, and one bronze medal and a diploma each by the Central Prison at Agra and the Elgin Cotton Mills.

113. **Melbourne Exhibition.**—Mr. Buck presided over the Indian Committee at Melbourne. The contributions of this Department were on a much larger scale than

they have been at any other Exhibition. Specimens of the following wares were purchased and exhibited at its own risk :—

Agra stone and marble work,	Lucknow chintzes,
Do. carpets,	Bánda stones,
Aligarh cotton cloth,	Benares brass work,
Bareilly carpets,	Azamgarh satin,
Bijnor wood carvings,	Ditto pottery,
Moradabad metal ware,	Jhánsi carpets,
Mainpuri wood inlaid with wire,	Ditto peacock feathers,
Farukhabad chintzes,	Ludhiana cloth,

and a collection of stones and natural products made by Mr. Buck.

Besides these, which only formed the nucleus of the contributions, a very large and miscellaneous collection representing nearly every industry in the Provinces was sent by private individuals and firms through the agency of the Department, and on somewhat indefinite terms, which in some instances gave rise to troublesome correspondence when the Exhibition was closed.

This Government was awarded medals or certificates for myrobalans, dyeing and other vegetables substances, lacquered work and stone ware, models of fruit and vegetables, wood work, carved and inlaid, oils and rice. Private exhibitors from the Provinces received medals or certificates in the following classes :—Cotton manufactures and tents (Elgin Mills and Muir Mills, Cawnpore); mats and carpets (Bareilly, Mirzapur, Agra, Basti and Allahabad jails, Jhánsi and Aligarh towns, and Lala Beni Prashad of Mirzapur) ; stone work, carved and inlaid (Nathu Ram and Sewa Ram and Mr. A. M. Seushner of Agra); Moradabad metal ware (Mir Imdad Ali, C.S.I.); teas (the Kausani and Lines tea estates); sugar (the Rosa Factory) ; goldsmith's work (Lalas Kalika Das and Sanwal Das of Lucknow) ; gold embroidery (Lalas Gopi Nath and Kishori Lal of Lucknow) ; Bareilly chairs (Messrs. Goslett and Co.), and beer (Naini Tal Brewery). When the articles were sent back it was found that some had been damaged and the original consignors refused to take back others. Some compensation had to be made, which was met partly by a draft on the Gházipur farm budget and partly from a grant of Rs. 2,000 made for that purpose by the Government of India. The proceeds of the articles sold at the Exhibition were thrown into the fund, and after discharging all liabilities the Department was left with goods on its hands of the nominal value of Rs. 1,671, and an unspent balance of the Government grant of Rs. 365.

114. **Museum.**—As long ago as June, 1880, a proposal was made for forming a collection of models and drawings of agricultural implements, &c., and Lucknow was suggested as the best locality for their exhibition. A special grant of Rs. 500 was made for the initial expense, and in reply to enquiries as to how much it would cost to maintain it, Rs. 200 per annum was estimated as amply sufficient. In pursuance of this scheme a collection of 61 models was made over to the Lucknow Museum last year, and a better set, embracing all the improved appliances which are likely to prove attractive to the Indian agriculturist, is in course of construction. A duplicate copy is being made by the Department for the Jaipur State Museum. It is now intended to take the Lucknow Museum into the direct charge of the Department, and the scheme will probably be extended so as to embrace, besides the collection of agricultural implements, agricultural products, and specimens of local art and manufactures for introduction to the travelling public and other possible purchasers.

115. **Myrobalans.**—The fruit of the *Terminalia chebula* and *Terminalia bellerica* are found in considerable quantities along the Oudh and North-Western Provinces' forests. They are a valuable tanning agent and have long been known to the Australian trade, though the demand for them at Calcutta appears to be on the decline. When Mr. Buck was at Melbourne, he arranged with a firm there (Messrs. Saunders and Co.) for the export of a large quantity, if possible 300 tons. The Forest Department was addressed, but it was found to be too late for their collection. In last autumn the subject was taken up again, but the firm did not now require so large a quantity, and

eventually arrangements were made for the despatch of a sample consignment from Pilibhít. The article is already well known to commerce, and its price is so low in comparison with its bulk and weight that it is very doubtful whether it will ever pay the cost of carriage from these Provinces to Australia or Europe. In the course of the correspondence the Conservator of Forests suggested that a market might be found for the inspissated juice of tanning barks and of potash prepared from waste material in the forests as a manure. He was informed that we should be glad to receive samples of either, and asked what the probable price would be ; but it appears that the Forest Department would be unable to undertake the manufacture themselves.

116. **Kachi emigrants.**—At the request of the Chief Commissioner of the Central Provinces a party of 17 of the industrious cultivators known as Kachis, whose families had originally been transplanted from Farukhabad to Cawnpore by Mr. Buck, were sent to settle at Nagpur on the Government farm.

117. **Ghi-makers.**—The possibility of promoting a large trade in ghi from the surplus produce of Australian herds had engaged the attention of the Government of India, and a considerable volume of information was collected on the subject of the method of manufacture followed here. Specimens of the cases used for keeping were sent, and eventually two experienced native ghi-makers were persuaded to emigrate from Cawnpore to Victoria. One of them has been reported a great success, the other suffered so badly from home sickness that he was returned to Bombay.

118. **Cattle-breeding.**—The project of establishing a cattle farm in the Dún, which had been the subject of much correspondence, was finally abandoned. The opinions of all well-informed residents and the local officials were unanimous in condemning its prospects. To enable the Department to purchase good bulls at local fairs, and from the best fields, with the object of selling them in places where the breed of cattle requires improvement, an imprest of Rs. 2,000 was placed at its disposal. Rája Jagat Singh of Tajpur and Pandit Ajudhia Parshad of Indulpur report that they have numerous calves by the stud bulls supplied to them by the Department. Arrangements for the purchase of a few bulls in the ensuing cold weather have been made with the Superintendent of the Hissar Farm. A few bulls have been imported of the Kenwaria breed in Bánda and resold in other parts of the Province.

119. **A revised edition of Mr. Fuller's Agricultural Primer** was published, and an Urdu translation, approved by the Director of Public Instruction, sent to the Press. It is proposed to print a large Nagri edition as well, and the Department of Public Instruction intend to have it taught in normal schools and distributed as prizes elsewhere. They do not consider that it is at present advisable to make it a compulsory subject for middle-class examinations.

120. **An illustrated hand-book of the field and garden crops** of these Provinces has been compiled. The botanical notices of each crop are by Mr. Duthie. Mr. Fuller contributed notices on the habits, methods of cultivation, distribution and allied subjects, while the pictures are by Mr. Hormusjee, a Parsee draftsman from the Bombay School of Art. The first volume, containing notices of all the most important crops, is in the Press and should shortly be issued.

XVI.—GENERAL.

121. During the year under report Mr. Wright held charge of the office of Director till April 16th, when he went on leave. Mr. Fuller was appointed to officiate and remained in charge till August 8th. Since that date I have held charge. In September Mr. Buck, the first Director, and to whom the Department mainly owes its present form, visited Naini Tal, and the Local Government in consultation with him arranged the programme for the ensuing year, of which the main features which have survived are the following :—

(1) To strengthen the existing staff of kanúngos in Oudh by appointing supervisors, and the introduction of the N.-W. P. system of examinations and an improved supervision of rural records.

(2) The establishment of a small model farm at Lucknow.

(3) The appointment of Major Pitcher to carry out these arrangements and be Assistant Director of Agriculture and Commerce for Oudh.

(4) An Engineer to be appointed to examine the Province and report on the possibility of extending well-irrigation.

In November, at a meeting with Dr. Schlich and Mr. Buck at Awa, a project for enclosing large areas of usar land, which had been broached at Naini Tal and received His Honor's provisional approbation, took a more distinct form and is now one of the most important of the subjects before the Department. In December I was sent to Calcutta and empowered by the Lieutenant-Governor to enter into arrangements for the establishment of an Agricultural School, the appointment of Mr. Hill as Principal of the School and scientific adviser to Government, and the transfer of the proposed meteorological observatory to the site of the School. It is understood that the proposals then agreed to have been sent for the consideration of the Secretary of State. The subject of emigration was discussed both with Mr Buck and the principal emigration agents at Garden Reach, and Major Pitcher was deputed, under the direct orders of the Government of India, to make a special enquiry into the working of the present system in these Provinces.

122. A short abstract of the total expenditure for the year is given in the appendix. The following reports were submitted during the year :—

Cawnpore Farm ...	Rabi 1881 ...	1st July, 1881.
Ditto ...	Kharif 1881 ...	28th March, 1882.
Lucknow garden ...	1880-81 ...	11th July, 1881.
Saháranpur gardens	1880-81 ...	Ditto.
Administration report	1880-81 ...	11th April, 1881.
Cotton report ...	1880-81 ...	23rd November, 1881.
Arboriculture ...	1880-81 ...	26th September, 1881.
Tobacco ...	1880-81 ...	12th October, 1881.
Sericulture ..	1880-81 ...	22nd ditto.
Court of Wards ...	1880-81 ...	28th March, 1882.
Rabi crops and weather	1880-81 ...	1st September, 1881.
Kharif ditto	1881 ...	11th March, 1881.
Foreign trade report	1880-81 ...	23rd July, 1881.
Road traffic report	1880-81 ...	6th August, 1881.
Railway-borne traffic	1880-81 ...	13th October, 1881.

Quarterly trade reports.

To 31st December, 1881 ...	11th July, 1881.
„ 31st March, 1881 ...	5th ditto.
„ 30th June, 1881 ...	16th October, 1881.
„ 30th September, 1881 ...	21st January, 1882.

123. My obligations to both the permanent Assistants in the Department—Mr. Fuller and Mr. Wilson—are greater than I can properly acknowledge. To the former the Department owes nearly the whole of its practical organization in all its many and heterogeneous branches and the whole of whatever results have been obtained in experimental farming and traffic registration. He is now on deputation in the Central Provinces, where he will find a worthy field for his energy and great practical ability. Mr. Wilson's scientific attainments and habits of patient and accurate observation have been of the greatest use, and I cannot sufficiently thank him for the readiness with which he has always helped me in forming an opinion on all subjects which fall within the range of his investigations.

I have the honor to be,

SIR,

Your most obedient servant,

W. C. BENETT,

Director, Dept. of Agri. and Commerce,
N.-W. Provinces and Oudh.

APPENDIX AI.

	Budget expense	Budget receipts.	Actual expense.	Actual receipts.	Net expense.	Saving on budget grant.
	Rs.	Rs.	Rs. a. p	Rs. a. p.	Rs. a. p.	Rs. a. p.
1. Office establishment and contingencies.	31,500	*Nil.*	29,552 2 1	*Nil*	29,552 2 1	1,947 13 11
2. Gházipur tobacco farm ...	6,000	6,000	5,914 11 6	6,000 0 0	*Nil.*	85 4 6
3. Sericulture	2,500	2,000	*Nil.*	*Nil.*	*Nil.*	2,500 0 0
4. Reh experiments... ...	5,000	*Nil.*	5,000 0 0	*Nil.*	5,000 0 0	*Nil.*
5. Traffic registration ...	13,000	*Nil.*	12,852 0 0	*Nil.*	12,852 0 0	348 0 0
6 Cawnpore Farm and Workshops.	21,500	9,000	16,525 1 9	5,094 6 3	11,430 7 6	4,974 14 3
7. North Indian manufacture ...	5,000	5,000	5,482 7 10	6,543 8 8	*Nil*	*Nil.*
8. Seed imprest	2,000	2,000	2,526 7 3	2,526 7 3	*Nil.*	*Nil.*
9. Bull imprest	2,000	2,000	1,126 1 0	251 13 6	874 3 6	873 15 0
Total ...	88,500	26,000	78,978 15 5	20,416 3 8	59,708 13 1	10,729 15 8
	Funds spent under the control of the Department.					
1. Lucknow gardens ...	13,500	9,500	13,500 0 0	9,591 12 9	3,908 3 3	*Nil.*
2. Sahâranpur gardens ...	30,000	6,000	29,164 12 8	6,937 0 9	22,227 11 11	835 3 4
3. Allahabad (Mr. Phillips' pay),	4,500	*Nil.*	4,500 0 0	*Nil.*	4,500 0 0	*Nil.*
4. Arboriculture	53,300	16,000	46,892 8 2	33,630 5 5	13,262 9 9	6,407 7 10
Total ...	1,01,300	31,500	94,057 4 10	50,159 2 11	43 898 8 11	7,242 11 2

	Realization.	Expended.	Balance saved.
	Rs. a. p.	Rs. a. p.	Rs. a. p.
Patwâris and kanûngos	24,59,444 14 6	22,62,370 11 7	1,97,074 2 11

NOTE —1 does not include salary and travelling allowance of Director and Assistant Director.

5 does not include Rs. 10,228-8-0 contributed by Government of India.

7, 8, 9, are imprests. 7 includes receipts of Rs. 2,412-1-5 on account of goods sold in the previous year.

A separate account of the Ghazipur fund will be submitted shortly

APPENDIX II.

Note by MR. WILSON *on work in connection with the deterioration of soil by reh, &c.*

THE work may be classified under three heads:—

I.—Agricultural experiments.
II.—Survey of villages in the Akrabad pargana, Aligarh district.
III.—Preparation of provincial reh and usar maps.

I.—Agricultural experiments.

2. The sub-committee appointed to frame proposals as to the form which the experiments should take recommended that they should comprise—

Arboriculture,	Flushing,
Surface drainage,	Manuring, and
Sub-soil drainage,	Growth of special crops.

3. *Arboriculture.*—The total area of the experimental plantations is 103·24 acres, distributed thus—

In Awagarh	39·95 acres.
In Janauli	48·70 „
In Jaithra	15·49 „

Of this area 64·05 acres were taken up in 1880, but owing to the scanty rainfall the sowings practically failed, and in May, 1881, not more than 10 per cent. of the beds contained plants. Out of the 64·05 acres holes were dug 55·05 acres, the remaining 9 acres being prepared either in a series of ridges and furrows, or by digging channels and making the soil into ridges on one side. In this 9 acres the sowings failed entirely: so the ridges have been given up and holes dug 20 feet apart, the earth excavated from one hole being thrown into the next.

4. The new plantations are:—

	Acres.
(i) In Awagarh.	28·43
(ii) In Jaithra	10·76
Total ...	39·19

In these the land was prepared by digging holes 10 feet apart, 3 feet deep, 3 feet wide at top and 2 feet wide at bottom, the soil excavated from one hole being thrown into the next. A layer of good soil 3 to 6 inches thick was put on all the beds, as the previous year's experiments had shown that the seed rarely germinated if this was not done. At Jaithra the good soil was obtained from some sandy waste near the plantation; but at Awagarh pits 10 feet wide were dug to the level of the sub-soil water, and the soil thus obtained was used to make the seed beds.

5, The tracing attached to this note gives a plan of the Awagarh plantation, and cross sections showing the different kinds of soil obtained in digging wells.

The surface soil, called *kabsa*, is light colored and very hard and contains an excess of saline matter. Its thickness varies from 2 feet at T to 6 3 at M.

In most of the wells below the *kabsa* there is a stratum of yellow clay, and below that a stratum of sandy loam, called *bhasua;* but in some places the better soil lies directly under the *kabsa*. In some of the wells the junction of the *kabsa* and the yellow clay is distinctly marked, while in others the change from one stratum to the other is gradual and no distinct line of demarcation exists.

In the well at A there is a thin stratum of grey sand.

Kankar occurs in the lower part of the stratum of *kabsa*, occasionally in blocks, but generally in nodules varying in size from a pea to a hen's egg, There are also small nodules of kankar scattered through the upper part of the sandy loam and in the yellow clay.

It will be noticed that the strata vary considerably in wells close to one another. For instance at F and K the *kabsa* is underlaid by a thick layer of clay, which extends to below the level of sub-soil water, while at H and G, about 200 feet off, there is no trace of clay above the percolation level, and at J, about 200 feet in the other direction, there are 1½ feet of sandy loam between the *kabsa* and the clay.

It was found that the seeds germinated very freely in beds covered with the sandy loam, but not so readily in those covered with the yellow clay.

6. The rainy season of 1881 was very different in character from that of 1880, as is shown by the following table :—

Month.	Inches of rainfall in	
	1880.	1881
June	...	4·3
July	6·1	17 9
August	0 8	13 2
September	3·6	0 8
October	...	...
Total ...	10 5	36·2

The total rainfall during the four months of last year amounted to 36 2 inches, and of this 17 inches fell between the 17th and 26th of July.

7. The plantations were sown in June, as soon as possible after the first rain fell, and the seeds germinated well ; but the young plants were not strong enough to withstand the floods that occurred in July, when the plantations were entirely submerged for some days. When the floods subsided the beds were resown, but the second sowings were not completed before the middle of August, and the greater number of the seedlings succumbed to the weather in September and October. A few plants that have survived from the first sowings are strong and healthy, but taken as a whole the sowings failed.

8. In June some kikar nurseries were started in good land and in September a number of seedlings were planted out in the plantations. Before the end of the year more land was taken up for nurseries and sown with kikar, and the young plants were put out in the plantations in February and March. The plants were put 20 feet apart, as there were not enough to stock all the beds in the plantation.

Kikar sends down its tap-root very rapidly, but there is no difficulty in transplanting it if it is not allowed to grow too large in the nursery. I think that the seedlings are best planted out when 18 to 30 inches in height, but young trees 4 feet high have been planted out successfully.

9. When these experiments were started it was considered advisable to find out what could be done without using canal water ; the plantation at Sikandra Rao, on the Ganges Canal, having shown that where canal water and silt were available, a kikar plantation could be raised in bad usar. Accordingly only 28·52 acres (in Janauli) were irrigated from the canal, the rest of the land being watered by gharrahs or pipes filled by hand. But the latter system has proved too expensive, and young trees do not thrive so well under it as when canal water is used.

The plantations were inspected in November by the heads of the Agricultural and Forest Departments, and it was decided to recommend the preservation of a large area of usar land for arboricultural purposes and to limit operations to land irrigable from the canals. Since December all the plantations in Janauli and Awagarh have been watered from the canal.

10. In part of the Janauli plantation which has been irrigated from the canal since the experiments were started channels were dug along each line of seed-beds

and were filled with canal water about once a month. The channels are 12 inches deep, 9 inches wide at bottom and 12 inches wide at top.

The remaining plantations in Awa and Janauli have been irrigated by flooding, the land being divided into kiaries with water-courses between them.

At Jaithra canal water is not available and the plantations are still irrigated by means of gharrahs. The usar is of a much better type than that near Awa, there being very little efflorescence on the surface and not much kankar in the soil. The plants are getting on well.

11. The nurseries and some of the plants in the Jaithra plantation were covered with grass to protect them from frost during the cold weather. The plants in the Awa and Janauli plantations were left uncovered, but the long grass in the plantations afforded some protection. I did not find any of the unprotected plants killed by the frost, but they did not grow during the cold months, while those that were covered with grass threw out new shoots in December and January. It appears worth while to protect all young plants 12 to 18 inches in height, which may be planted out towards the end of the rains, and it will prove advantageous to keep the grass over the plants during the hot weather, as it checks the evaporation from the soil.

12. In 1880 some seeds of chaunkar and nim were mixed with the kikar and sown. The chaunkar seeds did not germinate so freely as the kikar, but a number of the plants are still alive. Last year no seeds of this tree were sown, but on the recommendation of Dr. Schlich, Inspector-General of Forests, two maunds of the seeds have been obtained from the officer in charge of the Changamanga plantation in the Panjab, and some of it has been sown in nurseries.

The nim seeds germinated well, but the seedlings died off in the following hot weather. They require more frequent watering than they can get in the plantation and must be raised in nurseries. Some young trees 4 to 7 feet in height were planted out in one of the Awagarh plantations during last cold weather. They have since been irrigated from the canal about once a month and look very healthy.

Some shisham trees from 4 to 7 feet in height were planted out in the same plantation in January, 1881. They were watered by means of gharrahs or pipes filled by hand. The tops of all the trees watered by gharrahs and of some of those watered by pipes dried up during the following hot weather, and some of the trees have died. Those that survived have thrown out fresh shoots since the plantation has been irrigated from the canal and now look very healthy.

Some farash trees planted last year in part of the Janauli plantation are doing well. They were raised in a nursery from slips.

13. There is I think no doubt that the best trees for usar are kikar and chaunkar. They are hardy and require but little moisture, and they are found more commonly than any other trees scattered over usar plains. The pods and leaves of both are used for fodder, and their foliage is not dense enough to prevent the growth of grass. Shisham and nim require more moisture and may be planted along the main water-course, with a view to improve the soil by the accumulation of leaf manure.

Whether chaunkar will bear transplanting or not I cannot say, as it has not yet been tried; but, as mentioned in para. 8, kikar appears to stand it very well if not kept too long in the nursery.

The great advantage of planting out is that the plantation can stand a heavy flood or a break in the rains better than when sowing *in situ* is adopted. In 1880 the sowings failed owing to the deficient rainfall, and in 1881 the failure was due to the floods caused by the heavy rain in July. Of the young trees that were planted out at the end of last rains and in the cold weather not more than 25 per cent. have died.

14. Since cattle have been kept off the land the grass in the plantations has become very thick and has spread over some places which were quite bare. The grass which is commonly found on usar plains is called *kar-usara* and has been identified by Mr. Duthie as *Sporobolus orientalis*. It resembles *dûb* in its mode of growth and its roots go to a considerable depth. In one of the wells in the Awagarh plantation I traced the roots through the surface stratum of *kabsa* 5 feet thick into the sandy loam. It remains green throughout the hot weather. If it is dibbled during the rains at intervals of two or three feet in perfectly bare usar the ground will be covered with the grass in a few years. But cattle must be kept off the land, or they will graze on the young shoots and disturb the newly-formed roots with their feet. In places where the surface soil is washed off during the rains the erosion must be stopped by dividing the land into small kiaries, or the grass will not grow.

It is a capital fodder grass, both horses and cattle eating it readily when it is green. If it is cut and dried at the end of the rains it makes good hay, and cattle will eat it in this state if it is cut and mixed with some green food. The following table gives the results obtained from some experimental cuttings made in December:—

Name of plantation.	Month in which the land was taken up.	Weight of grass cut from 400 square feet.	Weight of grass per acre.			Remarks.
		lb.	M.	s.	c.	
Janauli, north of road	March 1880,	30	39	34	0	Watered by gharrahs.
Ditto, south of road	Ditto,	40	53	5	0	Irrigated from canal.
Ditto, between the rajbahas ...	Ditto,	28	37	7	0	Watered by gharrahs.
Awagarh, No. 1	Ditto,	21½	28	22	0	Ditto.
Ditto, No 2	May, 1881,	12	15	38	0	Ditto.
Jaithra, No. 1	May, 1880,	8	10	25	0	Ditto.
Ditto, No. 2	May, 1881,	6	7	39	0	Ditto.

The grass was cut in the morning and weighed in the evening of the same day. As Jaithra the grass was put in the sun for three days and weighed again, but it had not lost any weight.

The plantation at Janauli, south of the road, has been irrigated from the canal since November, 1880, and had received a watering about a fortnight before the grass was cut: so the grass probably contained more moisture than that cut in the other plantations, none of which had been irrigated from the canal up to the time when the cuttings were made. Except for experimental purposes, no grass has been cut in any of the plantations since they were started.

The area of each plot was 400 square feet, and the grass in the plots was no thicker than in other parts of the plantations where it was firmly established. But parts of the plantations are perfectly bare: so the weight of grass per acre deduced from an experimental cutting is not the average for the whole of a plantation.

The figures show very clearly the effect of preserving and irrigating the land. The plantation at Awagarh (No. 2), which was started before last rains, gave only 16 maunds (=about 12 cwt.) per acre, while the three unirrigated plantations in Awagarh and Janauli, which were taken up before the rains of 1880, gave from 28 to 40 maunds (=1 to 1½ tons) and the irrigated plantations in Janauli 53 maunds (nearly 2 tons) per acre.

The plantations at Jaithra yielded a comparatively small quantity of grass, but they were not often inspected, and it is probable that they were not properly preserved.

15. A grass called "bhurburri" (*Sporobolus commutatus*) comes up during the rains in patches of usar that are bare during the hot weather, but it affords very little fodder and dies directly the rains cease.

A coarse grass called *dâb* also occurs in parts of usar plains, but I think that the soil on which it grows is of better quality than that on which *kar-usara* grass will

thrive. It is not a good fodder grass, but is occasionally used for thatching. It is not confined to usar plains, but is found also in cultivated fields of poor quality.

Patches of *dúb* grass are also found in usar plains, chiefly in slight depressions where water lodges. It appears to spread if the land is flooded from the canal, but I doubt if it will displace *kar-usara*. Several other grasses are found on usar plains during the rains, but they are not of much importance, and the effect of preserving the land is to develope *kar-usara* grass very greatly and to leave no room for purely rain grasses.

16. The plantations are surrounded by a shallow ditch and low bank. Kikar seed was sown on the greater part of the bank during the rains. Here and there where the soil of the bank is good, there is a good hedge; but where the soil is real usar there is not a tree on the bank.

Agaves have been planted along part of the boundary of the old Awagarh plantation. They are still alive, but do not look healthy, and I doubt if they will grow sufficiently to form a good hedge.

It is essential to keep cattle out of an usar plantation, and I think that the best fence for the purpose will prove to be barbed steel wire with stone posts. Two strands of wire should be sufficient. A ditch one foot deep should be dug and the earth made into a low bank, above which the wire should be stretched. The ditch is required to keep carts away from the posts. A fence of this description will cost from Rs. 400 to 500 per mile.

17. *Surface drainage.*—In 1880 a plot of land was prepared in a series of ridges and furrows, in order to see if the rain would wash the salt out of the ridges. The ridges were sown both during the rains and in the cold weather, but most of the seeds failed to germinate and the few plants that came up dried when they were a few inches high.

18. The heavy rains of last year afforded a good opportunity of noting the effect of surface drainage on usar land, and I am convinced that most usar plains are getting worse and worse every year owing to denudation. This is most marked near drainage cuts, but may also be absorbed in the neighbourhood of raised roads and canal distributries, by the side of which borrow-pits have been dug. Any excavation that favors the rapid escape of rain-water from the surface of an usar plain increases the erosion of the surface, and where erosion occurs there is no grass.

It has frequently been observed that the bare patches on an usar plan are slightly lower than the spots on which grass is growing, and this is generally attributed to the saline matter having been washed off the higher spots and collected on the lower. A more probable reason appears to be that the surface soil in which grass was growing has during the rains been washed off parts of the land, leaving them quite bare. As noted in para. 14, *kar-usara* grass will not grow in places subject to erosion.

The only way to prevent denudation is to preserve the land and let the grass grow. If an usar plain is covered with long grass the velocity of the rain-water flowing over it will be greatly reduced, and instead of the usar land being eroded, it will receive a deposit of the fine silt with which the water flowing from the adjacent fields is loaded.

19. *Sub-soil drainage.*—Two-inch pipes with collars were laid 20 feet apart, 2′·6 to 3′ deep and with a slope of 6 inches in 100 feet. The pipes discharged into a channel, and the water that drained into it was baled out. But the land silted up during the rains and the land showed no signs of improvement. A further experiment will be made during the ensuing cold weather.

20. *Flushing.*—A plot of land was dug to a depth of 3 feet and all the kankar in it was removed. It was flooded with canal-water every week when the distributary near it was running. Some hemp which was sown in field of good land in the neighbourhood was ploughed into part of the plot. A mixture of wheat, barley, and peas was sown in half of it and mangold-wurzel in the rest, but no crop was obtained. After irrigation the plot was covered with saline efflorescence.

21. Though it does not appear that flooding land with canal-water and leaving it to be absorbed by the soil or evaporated does much good to bad usar, considerable benefit results from allowing water carrying silt to flow over the ground, so that the silt may be deposited. There are some small plots of usar between a new channel and the Etáwah branch of the Ganges Canal which a year ago were covered with efflorescence, but are now covered with silt, with *dûb* grass growing on it.

In parts of the Ganges Canal which are in embankment, and where there is danger of the banks breaking and the adjacent lands being flooded, silt tanks have been constructed in order that the banks may be strengthened by a deposit of silt outside them. Some of these tanks are in usar, and there are now good plantations on the silt with which the land has been covered. The object of the canal officers being simply to strengthen the banks a width of one to two hundred feet has generally been taken up for the silt tanks, but where such tanks are constructed in usar it should prove profitable to take up as much land as is available for the purpose. The extra cost will not be considerable, and in some places the revenue obtained from the land should pay the whole cost of making the tank.

I would suggest that the land should be dealt with in the following way:—As soon as sufficient silt has deposited in any part of the tank, it should be formed into a series of ridges and furrows, the tops of the ridges being about 6 inches above the ordinary level of water in the canal. The ridges should be sown with kikar and shisham. The water will fill the furrows and no expenditure will be incurred for irrigation.

Of course a silt tank can only be made in places near a canal where the ground is below the level of the water in the canal, and there are not many usar plains where this system of planting can be adopted; but it appears worth considering whenever the requisite conditions exist.

22. *Manuring.*—The plots that were treated with chemical and other manures in 1880 were again sown both in the rains with a mixture of juar and hemp, and in October with wheat, barley, and peas. The result was similar to that obtained in 1880, no crop being produced on any of the plots.

As noted in para. 20, the effect of green soiling was tried on one of the plots that were dug to a depth of 3 feet, but without success.

23. *Growth of special crops.*—Seeds of *madar* (*Calotropis procura*) was sown during the rains, but though the seed germinated fairly well the young plants died when they were a few inches high.

Considering the ease with which it can be made to grow and its value for fodder, *kar-usara* grass appears to be the most suitable crop to encourage in usar, and very beneficial effects may ensue from the accumulation of vegetable matter that will result. In *Johnston's Elements of Agricultural Chemistry* it is stated that on an average the *annual* production of roots on old grass-lands is equal to one-third or one-fourth of the weight of hay carried off, though no doubt it varies much both with the kind of grass and kind of soil. The growth of the roots depends on that of the leaves, and if the grass is grazed during the rains, which is the time when the leaves and stems grow, the root growth is greatly diminished. In addition to the increase of dead roots in the soil a considerable amount of vegetable matter will accumulate at the surface of the ground through the leaves of the grass drying, and this may be increased by cutting the grass occasionally during the rains and letting it rot on the ground.

In addition to the accumulation of vegetable matter in and at the surface of the ground, the excess saline matter and the soil should be reduced by growing this grass. Soda is particularly abundant in the stems and leaves of those kinds of vegetation which grow in soils containing salts of Sodium (*Johnston's How Crops Grow*). The fact that the *kar-usara* grass grows readily on usar plains, while it is not found in ordinary pasture-land, shows that the soda salts found in usar are essential to its growth, and some of the salts will be removed when the grass is cut for fodder.

II.—Survey of villages in the Akrabad pargana.

24. Until October, 1881, the establishment employed on the survey consisted of a munsarim at Rs. 75 per month and two amins at Rs. 20 per month, but in November the munsarim was dismissed and 3 amins were appointed in his place.

The whole of the villages surveyed during the preceding year were checked, as some inaccuracies were discovered. The amins are now used to the work and are doing it much more rapidly and accurately than they did at first. Out of the 65 villages 29 had been surveyed up to the end of March.

Whether reh is increasing or decreasing the change is very slow, and sufficient time has not elapsed since the survey was started to come to a conclusion on the subject.

III.—Provincial Reh Map.

25. Returns showing the area of usar in each village of the North-Western Provinces were received from District Officers, but it has been found necessary to send back the papers for many parganas for explanation of the differences between them and the figures given in the comparative statement (milan-khasra) for 1279 fasli. Omitting those parganas the map of the whole of the Ganges-Jumna Doab and of part of Rohilkhand has been prepared.

26. The grant for the year on account of agricultural experiments, the reh survey, and the provincial reh map was Rs. 5,000, and the whole of this was expended, *viz.*—

	Rs.	a.	p.	Rs.	a.	p.
On the reh survey and map				2,410	12	11
On agricultural experiments—						
Arboriculture	1,630	0	0			
Other experiments	959	3	1			
				2,589	3	1
				5,000	0	0

The sum expended on plantations was supplemented by an equal amount supplied by the Awa estate.

W. J. WILSON.

APPENDIX III.

Extracts from communications by Native Gentlemen.

1.—From Pandit Ajudhia Parshad of Indulpur.

I have the honor to submit my report of the agricultural operations conducted on my farms during the year, 1881 and 1882.

I shall commence as usual with the kharíf grains.

Urd, mung, moth, and *bajra* were tried extensively as usual, but did not yield any favorable outturns owing to the drought.

Til, the cultivation of which is peculiarly suited to these parts, was an utter failure, because the plants when they came to flower were attacked by a species of red insect which ate up the flowers and left bare stalks.

Rice.—Of this the upland kind, which succeeds only in wet years, was, owing to the dryness of the season, a thorough failure.

Valley rice was sown in the river-beds as usual and was at first very promising. It yielded a very fair outturn, but this year rats were so numerous that the injury which they did to the crops was materially felt by the cultivators. Some of the rat-holes that were dug up were found to contain nearly a maund of rice. This extra increase of rats may be attributed to the fact that in former years the rainfall used to be greater, and consequently water entering into the holes used to drown them. This year such not being the case, the rats multiplied greatly. In spite of the injury done to the crop owing to rats and low rainfall the produce still amounts to 14 maunds per acre.

Rabi grains.—*Wheat.*—Of this three sorts were sown in five farms. Their names are as follows :—Samharea, Katha, and Muzaffarnagar soft white wheat.

The first kind was experimentally tried by me last season and the seed obtained from my lands was sown by me this season. The result per acre of this kind was greater than that of the Katha ordinary kind, as the table given below will show.

Katha wheat was extensively cultivated, but yielded an outturn very poor as compared with that of the other two kinds.

Muzaffarnagar soft white wheat.—A few maunds of seed of this kind was supplied to me by the Department of Agriculture and Commerce and was cultivated in farm No. 1, the field in which it was tried being the one in which sugarcane was grown in the previous year (Pindrawur); the field was not manured again and was irrigated once only. I have now got seed sufficient for cultivation in all my farms and for distribution to the asamis for trial next year.

Table showing the produce per acre of the three kinds of wheat.

Name.	*Produce per acre.*		
	Mds.	s.	c.
Katha	3	16	0
Samharea	6	37	0
Soft white wheat	11	0	0

The rest of the rabi grains were as usual, and nothing extra is therefore to be said about them.

Mangold-wurzel.—The Department of Agriculture and Commerce sent me some seed which I tried in two different places, great care being subsequently devoted to its cultivation. The outturn amounted nearly to 200 maunds per acre. The roots were very large, some of which weighed nearly five seers: some of which I showed to you when you were out on tour, which were good sized, although not fully mature.

Mangold-wurzel would not do for these parts for two reasons: 1stly, no seed can be raised here. Anyone wanting to cultivate it must get seed from England. The ordinary cultivator can do so only through the Collector of the district or through the Department of Agriculture and Commerce. Both these plans are nearly impracticable for the cultivator of the ordinary class. 2ndly, grazing grounds are abundant in these parts, and thus to cultivate a costly fodder crop like this and water it six times is not only unnecessary but a mere waste of labor and money. It may do for cities where fodder is scanty, but here it will be entirely out of place.

Carrot seed was supplied by the Department of Agriculture and Commerce and was tried, but the produce was below the average. This was the case with the country carrots too, and this I think was owing to the want of moisture.

Turmeric was tried at Indulpur alone. The produce was as good last year. I have now got a large quantity of seed which will suffice for experiments on a large scale next season.

Guinea-grass.— This is a very good fodder crop and likely to do best in these parts. It does not require much irrigation. I am of opinion that if it is tried in the river valley it will yield fodder from year to year without much labor, and I have applied for more seed and will experiment accordingly.

Sorgho.—This year I treated sorgho exactly as the native cultivators treat *chari*—that is, I threw it along with urd and mung in a field, to see whether it would when thus treated yield as much produce as *chari*. I could not decide, as all the plants were poorly owing to the dryness of the season. There were a few healthy plants, and I wished to extract their juice and attempt making *ráb* from them, but by the time my sugar-mill could be set up the sorgho grain was ripe and the stalks had very little juice in them, so that to try and make *ráb* from them would be useless.

Cotton.—Cotton seed of four kinds was received from your Department and was sown in five farms. In four of these it was very promising at first: the plants were very healthy and bore large pods. All of a sudden, owing to the dryness of the season, the pods withered and fell down. The miserable produce that could be gathered after this mishap was so insignificant that to make calculations would be needless.

Tobacco.—In my last report I mentioned the fact that I had raised some seed from the plants. This seed I this year tried in four or five forms and distributed a great deal among the Muraos in my estate. The plants were very healthy and yielded a large crop. The native cultivators think—and I agree with them—that this kind does not yield per bigha the weight of leaves that country tobacco does, and they say that it is therefore less paying. Moreover, it is found that this leaf is not so strong in flower as the Kulkuti kind, which makes it less valuable for smoking in the *hukka*. I also sent some seed to Muraos residing in a village under the Court of Wards through the patwári, but hitherto the result has not been reported to me, although I asked the patwári to do so several times.

Sugarcane.—During the last six or seven years of my experience as a zamindar I noticed the geat loss to which the asamis were put by the pernicious system of selling cane-juice and ráb to the Mahajans. The Mahajan never pays all the money for which the bond is executed to the asami, but, if the amount be large, takes him to the registrar's office and makes him state there that he has received the full amount. The money is subsequently paid by instalments. Again, an asami when in want of money goes to the Mahajan, who agrees to pay him a certain amount and asks him to buy stamped paper for writing the bond. The poor man goes to the nearest post-office and buys the paper which he in his simplicity thinks the bond or dustavez, and then gives the paper to the Mahajan, who quietly takes it, blank as it is, gets two or three men to put their signatures to the paper as witnesses and keeps it with himself. The asami thinks that the bond has been duly executed and the amount of debt laid down therein, whereas really such is not the case.

The Mahajan can whenever he pleases write out a bond for any amount for which the paper is sufficient and can sue the asami accordingly. Some of my asamis were duped in this way and left blank papers brought by them with their Mahajan. I got possession of two of these papers this year after getting the amount paid for the asami and have got them with me.

Seeing these defects in the current system I set about the task of seeking for a remedy, and ultimately hit upon the plan which I followed last season. I started a *bel* of my own, but instead of bargaining with the asamis for juice as usual I bought cane and crushed it myself. I started with two Bihea mills, but when the supply of cane increased I used two more. When even four mills were not sufficient to crush all the cane I got daily, Mr. Porter, the Collector of Sháhjahánpur, very kindly got me four more. My hearty thanks are therefore due to him not only for this opportune supply of mills, but also for the kindness he did me by explaining to the asamis everywhere the advantages that would accrue to them if they sold their cane instead of juice. At first the experiment was not likely to succeed, as the asamis, not liking any innovation upon their established customs, hated the idea of selling cane, but seeing the advantages of the system and the profit which the braver few who had ventured to sell their cane obtained, they came to like the idea and ultimately sold their cane. Had the experiment not succeeded as it did I would have suffered severely, for I had already spent some hundreds in paying the hire for the pans, in constructing the house for the manufacture, and other sundry expenses. The following table shows the total expense I underwent in the business:—

	Rs.	a.	p.
Hire for bullocks to work mills	96	10	0
Wages to the boys who supplied the mills with cane	19	4	9
Buying of miscellanies: *e.g.*, oil, soda, cloth, &c.	46	3	0
Karigar, man who looked after the boiling and made ráb... ...	30	0	0
Jhukhha, man who tended the furnace and supplied fuel ...	17	12	0
Bhisti	7	8	0
Hire for the pans	48	0	0
Paid to potters for kursis, &c.	18	8	0
Carriage hire for Bihea mills	14	5	9
Hire paid for kolhus	80	0	0
Construction of bel-house	15	14	9
Price paid for sugarcane	996	3	9
Total ...	1,390	1	0

The ráb manufactured weighed 856 maunds 35 seers, of which the value is Rs. 1,713-12, at the rate of Rs. 2 per *ráb* maund kham, which comes up to Rs. 4 a maund by pucka weight, by which ráb is measured. This price is calculated according to the present rate. If I had sold my ráb at the season at which it was manufactured it would have brought me Rs. 5-10 per maund, which was the rate at the Rosa Factory, Sháhjahánpur. At this rate my ráb would be sold at Rs. 2-13 per kham maund instead of Rs. 2 per maund as here calculated.

I think it would not be out of place for to me describe briefly the *bel* system of making *ráb* which I followed last season.

Five iron pans are used in boiling the juice and making it into ráb. These are placed in the descending order of magnitude, the largest called *haud* (reservoir) being placed first and the smallest, *percha*, being last. From the *percha* upwards each succeeding pan is placed on a higher level than the one before it. All these pans are fitted on to a wide trench or furnace. This furnace has an opening on one side, just below the smallest pan (*percha*), through which fuel is supplied to keep up the heat. The furnace terminates at the other end in a funnel, through which smoke, hot air, and the other products of combustion pass out into the atmosphere. The working of the system is as follows:—When a sufficient quantity of juice has been obtained it is thrown into the highest and largest pan (*haud*), in which it is slightly warmed by means of

the hot air passing below. After a time part of the juice is poured into the next pan, *nikhara* (purifier), in which it gets strongly heated and a lot of scum rises to the surface, which is skimmed off by means of flat iron sieves attached to handles. Into this pan *sajji* (crude carbonate of sodium) dissolved in water is thrown from time to time, which causes all the scum to rise to the surface. In the next pan (*phula*) some more of the solution is used. The juice then is transferred to the *phadka*, where it becomes thick, and thence passing to the *percha* becomes ráb.

This *sajji* solution, which is obtained by boiling the *sajji* in water and then filtering the liquor, is in my opinion the best thing that can be used for cleaning the juice. Some say that it causes the ráb grain to become smaller; but this I think is not correct, because throughout last season I used *sajji*, and the grain of my ráb is very fine. Besides this *sajji* solution a mixture of this with oil is also used in every pan wherever there is a rising of the juice due to excess heat. The oil and *sajji* mixture immediately stops the rising and partly cleans the juice too.

The difficulty in the ordinary pan which I noticed last year is also met with in the *bel* pans. They are made of patches of iron rudely rivetted together. Of course it is almost impossible to prevent the juice from leaking in these clumsy things. A lot of urd flour mixed with pulp of the *bel* fruit and cane-juice is applied to the seams every day. This compound dirties the ráb and does not at the same time effectually prevent leakage. Captain Clibborn while he was here suggested that I should get cast-iron pans. I have applied for five of them through that gentleman and hope to be able to try them next year, when the result of this new experiment will be reported.

I have here given an account of the *bel* system only in which ráb is manufactured. The process of refining which the ráb undergoes subsequently I have not touched here, as my sugar-making is not yet finished. In my report next year I hope to be able to give an account of it.

Cattle.—In my report last year I stated that I had received a Konwaria bull from the Agricultural Department. I had ten calves in all from him during last year. Out of these one died. The remaining nine are very handsome, healthy, and powerful. Of these two are males and the rest females. They are much stronger than the ordinary calves in the village and promise to grow up into very strong cows and bulls. This breed no doubt, it appears, will be far superior to the ordinary one. Some of the people in my village had their cows served by this bull, and the young ones they had also corroborated the opinion I have formed by seeing those in my own herd.

An Arab donkey stallion was sent to me by the Superintendent of Mule-breeding Operations, at the recommendation of your Department, agreeably to my request. It arrived here at the end of last year. For a few months no people brought their pony mares to be served by it, but now some have. Next year I hope I will be able to report the result.

2.—Report of Agricultural Society, Bijnor.

The committee now submit to the members their report on the progress of the Bijnor Agriclutural Society during the year 1881-82.

The work of the institution during the past year was in the main marked with extended usefulness and increased appreciation on the part of the landed classes. The Society now comprises among its ranks almost all the leading landholders of the district, and the agricultural meetings that were convened in the different tahsíls of the district in November and December, 1881, have abundantly brought home its object and scope to the divers sections of the rural population. Each sub-division has now its agricultural interests protected by the establishment at its head-quarters of an agricultural sub-committee as a branch of the central committee at Bijnor. The sub-committees are to meet at the conclusion of each of the harvests, rabi and kharíf, and suggest schemes of agricultural improvement in connection with their respective charges. The Society has equally been fortunate in enlisting the interest and sympathy

of the *mukaddams* in the district, who have consented severally to pay an annual subscription of one rupee. The *mukaddams'* contributions will be applied to the carrying out such measures of agricultural reform as are calculated to directly benefit the several classes of the cultivating community. Among the sundry propositions that go to make up the Society's programme of operations for the current year, it will suffice here to mention the establishment of a cattle-breeding farm and the inauguration in December next of a series of biennial agricultural shows at Bijnor. The committee are also going to take steps to memorialize the Local Government on the subject of irrigation, upon which must finally hinge the whole problem of agricultural development, and they feel confident that the Government, which is always ready to further the cause of agriculture, will grant their prayer for the deputation of a special engineer to Bijnor, with a view to sifting the whole question of irrigation as connected with the construction of wells, canals, and dams on the smaller streams which drain the district.

The work of the Society might be appropriately arranged under the following heads :—

I.—Diffusion of useful agricultural information.
II.—Introduction of improved agricultural implements.
III.—Improvement of indigenous staples and introduction of new seeds.
IV.—Improvement of stocks.
V.—Protection from drought.

I.

The committee attach great importance to the dissemination of agricultural information that would lead to successful farming. The abstracts of the rabi and kharif experiments conducted on the Cawnpore Farm, which have been communicated to the members of the Society, would be of much service to all those zamindars who would care to introduce an improved state of things into their *sir* lands. The committee have also brought to the notice of the members the construction of wells on the new system devised by Mr. Bull and successfully introduced by Mr. Wyer, C.S., into the Dubari estate in the Azamgarh district. They now propose to issue in the present year a short pamphlet on cattle diseases and their treatment.

II.

The improved implements which the committee have imported and experimented with during the year just concluded fall under—

(1) *Ploughs.*—There are now the following number of improved ploughs in use in the district :—

Kaisar	15
Jones' Ryot plough	3
„ Kashtkar plough	3
Martin plough	1

These have all been found superior to the native implement, but to determine their respective merits and choose the best for general introduction into the district there was held a simultaneous trial of the several ploughs by a sub-committee consisting of Raja Jagat Sinha, Babu Dila Ram, Munshi Abdullah Khan, and Pandit Sri Lal. The highest place has been awarded to the Ryot plough on account of its good working, cheapness, lightness, simplicity, and consequent fitness for the district : the Kaisar plough of Cawnpore coming out second best. The latter would have easily won the first place but for its heavy draught, which tires the bullocks much more than the native plough. For crops requiring high cultivation however, such as sugar cane, wheat, potato, and cotton, none of the ploughs is so eminently fitted as the Kaisar plough, and it might with advantage be adopted by all landowners having strong bullocks for their home farms : while for the ordinary crops the Ryot plough undoubtedly does excellent work, though it does not so completely turn over the soil as the Kaisar. The Ryot is well adapted for the use of the general mass of cultivators,

and efforts will accordingly be made during the current year to introduce this implement on an extensive scale.

(2) *Sugarcane mills.*—None of the improved implements has so completely overcome the prejudices and traditions of the native cultivators as the Bihia sugarcane mills.

No sooner these were brought to the notice of the agricultural classes than their use was eagerly applied for, and the fact that no less than 175 mills were at work in this district during the past sugar season clearly proves that the superior quality of the juice extracted by, and economy of labour in the use of, the Bihia mill have already made it a favourite machine with the rural community. Messrs. Mylne and Thomson, who have established a depôt at Bijnor, have arranged for the supply of 400 mills during the next sugar season, and it is hoped that the demand will increase every year. The management of the depôt is not, however, all that could be desired, and unless the present state of things is improved on, the committee are afraid a larger section of the cultivators will sooner begin to look upon the implement with an unfriendly eye. The committee intend bringing this matter to the notice of Messrs. Mylne and Thomson, with a view to the removal of defects in their present arrangements and introduction of improvements. There have also recently been constructed some two or three new kinds of sugarcane mills in Bengal, and it is proposed to import and try them during the present year.

(3) *Cawnpore pumps.*—Two of these pumps are in possession of the Sherkot estate. They are only useful where the depth to the surface of the water is more than 10 or less than 20 feet, as they cannot raise water so cheaply as a double basket lift if the depth is less than 10, or as the *charas*, worked by bullocks, if the depth is more than 20 feet. But it would appear that the average depth to water for nearly half the district is not less than 24 feet, and the pumps cannot therefore be of general utility in Bijnor.

(4) *Winnowing machine.*—It has been proved by careful experiments made at Sherkot and Bijnor that by the assistance of this machine three men can clean 1½ maunds of grain per hour, which does not compare favourably with the native process of winnowing. Moreover, the working of the winnower requires the application of great force on the part of the workmen. The committee are not prepared to recommend its use except for selection of seeds for sowing purposes.

III.

The committee have tried the following new staples, classified under the kharif and rabi crops :—

Kharif.

1. Cotton: (*a*) Kulpahar, (*b*) New Orleans, (*c*) Upland Georgian.
2. American tobacco.
3. Jaunpur maize.
4. Sorgho. } Fodder crops.
5. Guinea-grass. } Fodder crops.
6. Ground-nut. } Fodder crops.

Rabi.

1. Wheat: (*a*) Muzaffarnagar wheat, (*b*) Tuscan wheat, (*c*) English purple wheat.
2. Barley: (*a*) Kotegarh barley, (*b*) Cape barley, (*c*) English barley.
3. Mangold. } Fodder crops.
4. Lucerne } Fodder crops.
5. English carrot. } Fodder crops.

IV.

The committee have from the outset directed their attention towards the adoption of some general measures for improving the local breed of agricultural cattle. Two strong bulls have been imported during the year under notice—one by Raja Jagat Sinha and the other by Raja Maharaj Sinha. The Sherkot estate had likewise obtained a couple of bulls, but unfortunately they died while on their way to the district. Raja Sheoraj Sinha of Káshipur is also, the committee believe, going to

procure one for his estate. The bull at Tajpur is fast becoming popularised, its services being freely given to all who care to send their cows. But as these stray efforts cannot lead to any great success in cattle-breeding, the committee have decided on establishing a cattle farm in the district during the present year. As another step towards the improvement of cattle, arrangements will also be made for the distribution of cattle-disease medicines during the months when cattle are likely to suffer from various forms of disease.

While on the subject of cattle improvements the committee cannot omit to mention that the Superintendent of Horse-breeding Operations in India has in the past year supplied, on the Collector's recommendation, a Norfolk trotter stallion with a view to promote horse-breeding in the Bijnor district. It is stabled at Huldaur under the care of Raja Maharaj Sinha, and the people fully appreciate the benefit of its services. A donkey stallion has also been received from the Superintendent, Horse-breeding Operations, and is under the care of Manager, Saháranpur estate. There have further been imported three Australian rams—one for Raja Jagat Sinha and two for the Sherkot estate. These are said to be much better wool-givers than the local breed.

V.

The committee have taken steps during the past year to construct a few wells with wedge-shaped bricks on the system of Mr. Bull, as they cost much less than the ordinary masonry wells. Raja Jagat Sinha has already sunk two such wells and the Collector of Bijnor is also having a few built on the Court of Wards' estates. But it is yet too early to recommend their general adoption, as no experiments have yet been made to test their irrigating power.

In conclusion, the committee would invite the active sympathy and aid of the members in the successful conduct of the agricultural show which they have decided on holding in December next. It is very important that the inaugural show should be made as attractive as possible to the agricultural classes, and that the various products of the district should be thoroughly represented on the occasion. The committee therefore beg that the zamindars of Bijnor will offer every encouragement to their cultivators to come forward and send agricultural produce and animals to the Bijnor Show.

3.—From Kanwar Harnam Singh Ahluwalia, Manager, Kapurthalla Oudh Estates.

Arboricultural operations.—The estate has made a move in this direction by calling upon its ryots to plant groves and trees on roadsides, and has issued printed forms, stating the terms on which the estate permits them to do so. The estate has also planted five nurseries (three bigahs each in area) on its own account. They are intended for planting trees round irrigation wells that have been sunk by the estate for roadsides, and for supplying the estate *asamis* who may wish to plant new groves or fill up gaps created by the death of trees in existing ones. The following are the kinds of trees that will be raised, being about 20,300 seedlings in each nursery :—

Mango.	Babul (Mimosa Arabica).
Tamarind.	Shisham (Dalbergia sisu).
Jamun (Enginia jambolana).	Pakaria (Ficus venosa).
Nim ((Melia azedirachta).	Tun (Cedrela toona).
Semal (Bombax heptaphyllum).	

The nurseries are thriving.

Improvement of the breed of cattle.—The first step was taken by the estate with this object by holding a cattle show at Baundi last year in October on the occasion of the Dasahra festival, and prizes were given to the best exhibitors as an encouragement to improving the existing breed of cattle.

Farm.—We have something like a farm here for experimental cultivation; but it will be necessary to wait for another year before any interesting information on any point of public interest can be forwarded to the Agricultural Department.

4.—FROM THAKUR UMRAO SINGH, TALUKDAR OF RUKHAOLI, MAINPURI.

I BEG to bring to your notice that I have found that the refuse of indigo plant which is thrown out of the vats after the extraction of its juice, if allowed to remain for three years exposed to the sun until it becomes crumbled, it is found by experience to be a first-rate manure. I tried it last season by throwing it into a field which was intended for wheat, and the outturn was as follows. To have a comparison I selected a field measuring 10 bighas, the half of which I manured with the usual dunghill (village rubbish or sweepings commonly called *ghura*), and the other half was manured with the refuse of indigo plant of three years old :—

	Number of bighas.	*Corn.* Mds.	s.	c.	*Bhusa.* Mds.	s.	c.
Manured as usual by dunghill richly manured ...	5	42	20	0	45	0	0
Manured purely by indigo refuse plant three years old, 30 cartloads	5	49	30	0	51	0	0

The fields were equally selected and equally taken care of; they were portions of one and the same field. Commonly-manured portion was watered four times during the season, whereas the portion manured by the refuse of indigo plants was watered five times, as it required so.

From this you will observe that the portion manured by the refuse of indigo plants required more watering. How far it is true I cannot say, but I was told that a field that is manured by the refuse of indigo plants does not need to be annually manured; its effect lasts for two years, or in other words for four crops sown and harvested successively. To test this assertion I did not allow the cultivator to manure the field in June last, as it is usually done by the cultivators, but I took the field myself and sowed it with seeds as follows :—

	Sown with makka. Bighas.	*Sown with cotton.* Bighas.
Commonly-manured portion	2½	2½
Portion manured by the refuse of indigo plants ...	2½	2½

The whole of makka field failed in consequence of the excessive and incessant rains. Cotton field seems to be very healthy in the portion manured by indigo refuse plants and it is far superior to the other portion commonly manured.

I will let you know the result of the outturn of the cotton field at the end of the cotton crop season, which I think will be about the beginning of December next.

I have attempted this year to make two or three pleasure roads all round about my villages and intend to plant trees on both sides. I have allowed my cultivators the privilege of planting trees on the roadside for their own benefit and use, and I believe that the village people are very fond of planting trees for various reasons which need not be detailed here; and if the other zamindars also do the like, of allowing their cultivators the privilege of proprietorship in the trees, fruits and wood, without a single pice reduction in the rent, I am certain they will very gladly plant trees, as much as they can find room to do so.

ORDERS OF GOVERNMENT.

No. 2087 of 1882.

FROM

THE OFFG. SECRETARY TO GOVERNMENT,

N.-W. PROVINCES AND OUDH,

TO

THE DIRECTOR OF AGRICULTURE AND COMMERCE,

N.-W. PROVINCES AND OUDH.

DATED CAMP LUCKNOW, THE 21ST NOVEMBER, 1882.

SIR,

REVENUE DEPARTMENT.

I AM directed to acknowledge the receipt of your No. $\frac{9}{74G}$, dated 30th September, 1882, with which was forwarded the fourth annual report on the Administration of the Department of Agriculture and Commerce for the year ending 31st March, 1882.

2. The numerous duties undertaken by the Department are shown under the following heads in the index prefixed to the report, *viz.* :—

I.—Village records.
II.—Traffic registration.
III.—Manufactures.
IV.—Construction of wells.
V.—Reh experiments and glass-making.
VI.—Arboriculture.
VII.—Public gardens.
VIII.—Sericulture
IX.—Tobacco.
X.—Fairs and agricultural shows.
XI.—Experimental Farm.
XII.—Workshops.
XIII.—Co-operation of native land-owners.
XIV.—Court of Wards.
XV.—Miscellaneous.

A large number of the questions connected with these subjects have already been separately reported on and suitably disposed of. The report therefore summarises the collective operations of the Department during the year, and comment on some of the more important topics treated of is all that is now called for.

3. *Village records.*—You rightly remark that to ensure the maintenance and compilation of accurate village statistics is one of the principal duties of the Agricultural Department; and in paragraphs 3-6 of your report the inspection work done by Mr. Fuller and yourself during the year is detailed. It is satisfactory to find that in several districts the records have been well and accurately kept; though in some districts, on the other hand, the results of your examination were different; and as these variations must often depend upon the degree of interest taken in the business by the district officers, the Lieutenant-Governor trusts it may be plainly and generally understood that the matter is regarded as important. The question of preparing village papers and training of patwáris, more especially in districts such as Basti and Gorakhpur which will come under settlement during the next few years, is under separate consideration, and need not be further referred to here. The public spirit shown by Rája Shankar Singh of Etah in opening and maintaining, entirely at his own expense, a school of surveying for the

sons of patwáris and others, merits acknowledgment from the Government, and this you are requested to convey to him. The patwári and kanúngo staff of the provinces is shown as consisting of—

Patwáris		20,647
Kanúngos—		
Sudder	35	
Registrar	195	
Supervisor	428	
		658
Total ...		21,305

4. *Traffic registration—Paragraphs* 7-12.—The system of registration followed during 1881-82 differed in no material respect from that of the previous year. Traffic was registered under three heads, *viz.*, (*a*) foreign traffic with Thibet and Nipál, (*b*) internal road traffic, and (*c*) railway traffic. Registration of the second class of traffic, *i.e.*, within the provincial limits, is kept up in order to collect statistics that may aid the Government in deciding where metalled roads or railways may be wanted. The returns of railway-borne traffic are compiled in the railway audit offices, and may be looked on as almost correct. They are of considerable value and interest to the commercial world as well as to Government.

The cost of traffic registration was shown as follows:—

	Rs.	a.	p.
Foreign traffic	4,614	8	0
Internal road traffic	12,852	0	0
Railway traffic	8,640	0	0
Total ...	26,106	8	0

of which Rs. 10,228-8-0 was borne by the Government of India, and the remainder by the Local Government. The sum of Rs. 4,821 must be added for the compiling, and Rs. 1,200 for the inspecting staff, making the total cost Rs. 32,127-8-0, an amount which is comparatively trifling, considering the value of the information obtained regarding the resources and trade products of the provinces.

5. *Manufactures—Paragraphs* 13-16.—In accordance with the orders of the Secretary of State, information is being collected as to the principal manufactures and handicrafts of the provinces. A shop is kept up by the Department for the sale of art manufactures at Messrs. Laurie and Staten's Hotel, Allahabad ; but, as might be expected, retail sales of this kind have no appreciable effect upon the development of the manufactures, which can only be established on the wholesale markets through regular dealers. Some arrangements are now contemplated for placing these articles in Europe, where it is believed a considerable demand exists.

6. *Wells—Paragraphs* 17-28.—The experiments in well-construction in Moradabad had been nearly brought to a close during 1881-82 ; and, under Mr. Crooke, Mr. Wilson continued the experiments on the Awa Estate. It is hoped that the reports by Captain Clibborn and Mr. Wilson, which are promised shortly, will elicit definite conclusions on

the subject of well-construction generally, as the question has an important bearing upon the improvement and extension of agriculture, and upon plans for the protection of these provinces from drought.

7. *Reh and glass—Paragraphs* 29-37.—Experiments for reclaiming reh-infected land by cultivation, drainage, and flooding seem to meet with little success, but in the course of time we shall find out whether reh is spreading; and some progress has been made in determining the trees and grasses that may advantageously be cultivated on *usár* ground. Experiments in glass manufacture were also proceeded with during the year, and are to be continued; though it is hardly probable that a few trials, made by officers without much leisure or special skill in the business will lead to any considerable discovery. The summary given of Mr. Wilson's conclusions appears to indicate that only the commoner forms of glass can be manufactured with any prospect of profit.

8. *Arboriculture—Paragraphs* 38-48.—The proposal that the operations under this head should be set forth in the annual Administration Report of the Department, instead of forming the subject of a separate report, has lately been sanctioned. During 1881-82, the young trees on 1,340⅛ miles of road already planted were still being tended, and 442¾ miles were newly planted with trees, the total cost being Rs. 35,981. The number of trees planted out during the year was 95,075, as compared with 65,938 in 1880-81. The total expenditure during the year was Rs. 46,892, and receipts from felling, lopping, fruit, and other sources amounted to Rs. 35,197, leaving the net cost to Government only Rs. 11,695. There has been a material extension of tree-planting; and in some districts the officers have evidently taken much interest in the work; while it is gratifying to learn that some of the large landowners have undertaken the care of considerable avenues. The Lieutenant-Governor would wish that the gentlemen mentioned in your 42nd paragraph may be informed that their co-operation is much appreciated. Under the circumstances represented, it would seem inadvisable to close the central nursery at Lucknow, although in order to secure distribution of the trees they are disposed of free of charge, and the cost of keeping the garden up, which is understood to be trifling, has to be borne by Government.

9. *Public gardens—Paragraphs* 49-55.—The public gardens under the charge of the Department are the Botanical Gardens at Saháranpur and the Horticultural Gardens at Lucknow. Orders have already issued on the separate reports submitted regarding them. It is sufficient to remark here that both gardens are working satisfactorily.

10. *Sericulture and Tobacco farms—Paragraphs* 56-62.—Sericulture operations in the Dún have been finally transferred to Messrs. Lister and Co., with whom the further conduct of the enterprise now rests. Measures for extending the growth of mulberry trees and the encouragement of cottage cultivation are under consideration. The tobacco farm has also been leased for 50 years, and the use of the steam plough engine has been offered to the leaseholders into the bargain. The plough itself has not fulfilled the expectations with which it was imported.

11. *Fairs and agricultural shows—Paragraphs* 70-82.—The chief fair in the provinces is that at Batesar ; and an interesting account is given by Mr. Fuller of the information collected in 1881 regarding the cattle brought to the fair, and the cattle trade carried on there. Agricultural shows were also held at Fyzabad, Lucknow, Gonda, Bulandshahr, Aligarh, Nauchandi near Meerut, and Saháranpur ; and they appear to be becoming popular and useful institutions.

12. *Cawnpore Experimental Farm and Workshops—Paragraphs* 83-93.—The Farm was ably conducted throughout the year by Mr. Fuller, and the Workshops for the greater part of the year. Much valuable experience in practical agriculture was acquired, the results of which have been fully set forth in the separate reports on the Farm and Workshops

13.. *Co-operation of native landowners—Paragraphs* 94-98.—You remark that the Department has a considerable correspondence with native agriculturists, not only in this province, but over the greater part of India This cannot fail to be useful and instructive, and it is hoped that other influential landowners will gradually follow the praiseworthy example set by the gentlemen whom you mention as having conducted experiments on their own account. The Lieutenant-Governor has read with interest appendix III. of the report, containing papers contributed by Pandit Ajudhia Parshad, Kunwar Harnam Singh Ahluwalia, and the Secretary to the Bijnor Agricultural Society, regarding their operations during the year.

14. *Operations on Court of Wards' estates—Paragraphs* 99-104.—Agricultural operations of various kinds were carried on on Karm Ali Khan's Estate in Meerut, the Dubari Estate in Azamgarh, the Kantit Estate in Mirzapur, the Rawatpur Estate in Cawnpore, and the Awa Estate. The most varied and important of the agricultural experiments are those conducted by Mr. Crooke at Awa. The want of trained practical agriculturists is much felt in cultivating experiments, and some time must elapse before they can be forthcoming, even if the project for a school of practical agriculture in connection with the Cawnpore Farm is carried out.

15. *Miscellaneous and general—Paragraphs* 105-123 —Amongst the topics noticed under this head few call for special comment. A considerable quantity of seed of different kinds was distributed during the year under report, not however with uniform success. The orchard at Mukhtesar promises to be most useful in introducing good fruit trees throughout Kumaun. The Lucknow Museum has been placed under the direct charge of the Department ; and the opportunity should be taken of re arranging the general collection, so as to give room and convenience for properly exhibiting the models and drawings of improved agricultural appliances. Projects for taking up *usár* land as fodder and timber preserves are now under inquiry, and the scheme for an agricultural school in connection with the Department at Cawnpore is still under consideration. Your staff was strengthened towards the end of the year by the appointment of Major Pitcher as Assistant Director of Agriculture and

Commerce for Oudh, and an improved system of preparing and supervising village records in Oudh is being introduced.

16. You acknowledge the valuable assistance you have received from Mr. Fuller and Mr. Wilson, the permanent Assistants in the Department, the former of whom has now been transferred permanently to the Central Provinces. The Lieutenant-Governor and Chief Commissioner concurs with your high opinion of Mr. Fuller's energy and practical ability, and of the services he has rendered to the Department in the North-Western Provinces. In conclusion, I am to thank you for your careful and interesting report. The range of duties and inquiries now committed to the direction of your Department is very wide, as it includes not only agriculture and commerce, two subjects practically inexhaustible, but it also brings you into relation with the whole organisation of the land-revenue system throughout these provinces. It seems worth your while to consider whether, with such a large field before you, you should not concentrate your attention and resources upon some of the more salient and immediately important points of inquiry or experiment ; and at any rate it appears advisable that the introduction of new machinery, and the investment of funds in the establishment of new industries, should be undertaken with much caution.

I have the honor to be,

SIR,

Your most obedient servant,

J. R. REID,

Offg. Secretary to Government,
N.-W. Provinces and Oudh.

FIFTH ANNUAL

REPORT ON THE ADMINISTRATION

OF THE

DEPARTMENT OF AGRICULTURE AND COMMERCE,

NORTH-WESTERN PROVINCES AND OUDH,

FOR THE YEAR ENDING 30TH SEPTEMBER, 1883.

ALLAHABAD:

NORTH-WESTERN PROVINCES AND OUDH GOVERNMENT PRESS.

1883.

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No. $\frac{G.}{1174a}$ OF 1883.

DEPARTMENT OF AGRICULTURE AND COMMERCE, N.-W. P. AND OUDH.

DATED CAWNPORE, THE 15TH NOVEMBER, 1883.

FROM

THE OFFG. DIRECTOR, DEPT. OF AGRI. AND COMMERCE,
NORTH-WESTERN PROVINCES AND OUDH,

To

THE OFFG. SECRETARY TO GOVERNMENT,
NORTH-WESTERN PROVINCES AND OUDH.

SIR,

I HAVE the honor to submit the report on the administration of the Department of Agriculture and Commerce for the year ending September 30th, 1883.

The last report dealt with the progress that had been made up to the end of March, 1882, and the report now submitted includes the operations of eighteen months. In drawing it up, I have as nearly as might be adopted the arrangement recommended in Government of India's letter No 445A. of May 14th, 1883, which was received under cover of your letter No. 1454 of June 23rd, 1883. Some of the topics therein prescribed are as yet in the stage of discussion, and no orders have as yet been received for definite action in regard to them. They present, therefore, no materials for a report which treats only of what has been done, and not of what may be in contemplation.

The first subject dealt with will be—

SECTION I.—THE ORGANIZATION AND MAINTENANCE OF VILLAGE RECORDS.

2. During the year under report the revision of the rules for patwáris and kanúngos has been completed. A final draft of the rules recommended by the Board of Revenue was submitted in September, 1882, and was passed, after a discussion which led to the introduction of a few amendments, by G. O. No. 270 of January 29th, 1883, which was given effect by the Board of Revenue's letter No. 124 of February 26th, 1883. On the receipt of sanction the rules were translated, and both English and vernacular copies were supplied to district officers in the first week of July. An explanatory circular, calling attention to all points in which the new rules differ from the old, was issued on July 2nd, 1883, and it was directed that the revised arrangements should come into force from the commencement of the agricultural year 1883-84. As the records for the current year have been prepared on the old system, the statistical returns, which are compiled from them by the registrar-kanúngos, will not be affected till a year later.

3. Among a large number of changes in detail the following main innovations may be noted :—

(1) It is authoritatively laid down that, as a rule, a patwári's circle should not include more than 1,500 acres of cultivation, or his pay be less than Rs. 7 per mensem.

(2) The employment of minors as patwáris or kanúngos (a sacrifice which had hitherto been often made to the principle of heredity) is distinctly forbidden.

(3) The records to be kept up by the patwáris are simplified by the amalgamation of the *wasil-baki* with the *jamabandi*. A distinct form is provided for the day-book, in which all receipts and disbursements are entered, and a separate ledger account for each co-sharer is substituted for the old *bujharat*. Minor changes in the

form of all the other records are introduced, uniform dates are prescribed for their commencement and completion, and the place for the deposit of the more important of them is transferred from the tahsíl to the *sadr* record-room.

(4) The responsibility for testing the records after they have been filed is attached to the registrar-kanúngos, and an assistant is provided to each, to enable him to carry out the new duty.

(5) Three registers (those of contracts, pensioners, and patwáris' heirs) have been abolished, and one for estates hypothecated to Government as security added. The forms of the tahsíl registers have been recast, and they will in future show all lands that have been held by the same tenant for more than twelve years, even though he has not been formally decreed a right of occupancy in them. The register of *jamabandi* testings has been dispensed with, and the testings will instead be noted on the *jamabandi* itself.

(6) The absence of supervisor-kanúngos from their circles while field work is going on, except at the express order of the tahsíldar, and their employment on commissions issued by revenue courts, are distinctly forbidden.

(7) Rules are given for the testing of the work of every grade subordinate to them by the sadr kanúngos, and for the submission by them of periodical accounts of the way in which they have discharged their duties.

4. The printing of blank forms for the use of patwáris had hitherto been done under the directions of the Collector for each district separately. The consequence was a considerable difference in the cost in different parts of the province, and a want of uniformity both in the kind of paper used and in the size, shape, and pattern of the forms. With the view of ascertaining whether any reduction could be made in the present expense, and of securing not only that the changes of the revised forms should be accurately made, but that they should be printed everywhere on paper of the same size and quality and in the same manner, this office was directed to superviso their issue for the present year. Patterns for each were adopted after a careful consideration of the space required for the several entries, and the execution entrusted to the leading firms of printers in the province.

5. A cheap and very effective method of tracing on corrected maps all changes in field boundaries and new cultivation had been spontaneously adopted by many of the patwáris of Meerut and Muzaffarnagar. Its general introduction has been sanctioned by the Board of Revenue.

6. A revised form for the pargana-book, in which officers of the superior grades will notice any points of interest in the fiscal history of each village which may attract their attention while on tour, and the registrar will excerpt the more important statistics from the tahsíl registers, has been devised and, at the orders of the Board, circulated for the opinions of selected officers.

7. The education of patwáris and their heirs has been withdrawn from the charge of supervisor-kanúngos, and rules for their instruction have received the approval of Government. Schools will be established at the head-quarters of each district under the charge of the Collector or one of his assistants. The subjects taught will be survey and mensuration, the use of the plane-table, arithmetic, and the rules and duties of patwáris. Out-door instruction will be given in the cold weather, and the teacher and his pupils engaged in the practical work of correcting maps. Patwáris already in office will not be compelled to attend except on the score of inefficiency ; but, after the schools have been open for a year, no new man shall be appointed who has not obtained a certificate at one of the periodical examinations.

8. The principal defects noticed during inspection tours have formed the subject of circular communications to district officers, and directions for the more accurate record of the construction of new or disuse of old irrigation works have been issued, under the orders of the Board of Revenue.

9. The rules for the maintenance and record of correct agricultural statistics have been in force for some years in all but the permanently-settled districts. The approach of a revision of settlement in Basti and Gorakhpur, and the exceptional inefficiency of the staff in those districts, which had formed the subject of frequent communications to Government, rendered the adoption of new measures indispensable. During the cold weather the following districts were visited, and complete proposals for the recasting of the patwáris' circles and the appointment of the necessary supervising staff were drawn up in communication with the Collectors of Basti, Gorakhpur, Jaunpur, Mirzapur, and Gházipur. These proposals have received the sanction of Government.

10. The completion of the arrangements for Bánda was attained by the communication of Government sanction to revised establishments in Tirohan and Chhibu, the only parganas remaining to be dealt with.

11. The patwáris in Lalitpur have hitherto been paid partly in cash and partly in land *jagirs*. Government has decided that in future the payments must be wholly in cash, and recommendations from the Commissioner of Jhánsi as to the method in which the conversion should be carried out have recently been submitted for the orders of the Board.

12. When these pending questions have been decided there will remain nothing further to be done in order to put every district in the province in a position to carry out the intentions of Government with regard to the submission of agricultural statistics, except the provision of a sufficient supervising staff for Benares and Ballia. This will be done as soon as the settlement of those districts has been brought to an end. Such information as is procurable appears to show that no new patwáris will be required, and that only a few supervisor-kanúngos need be added to the existing staff.

13. On June 23rd, 1883, a statement was submitted to the Board showing the total expense of the patwári and kanúngo establishment as at present constituted, including the cost of the new establishments for Basti, Gorakhpur, and the permanently-settled districts, and of all additions made to the staff by the revised rules. On 17th August, 1883, a further communication was made, with proposals for reconstituting the establishments throughout the province and an estimate of the total cost of introducing a revised scale of patwáris' salaries, in which the lowest should not fall below the minimum monthly pay prescribed by the revised rules.

14. Agricultural statistics, including the statements of area and crops for 31, and the statements of rental demand and collections and classification of holdings and revised rental for 28 districts, were compiled in this office for the first time and form an appendix to the Board's Administration Report. Those for Allahabad and Bánda will be completed for the current year, and the returns for the permanently-settled districts will be furnished as soon as the establishments required for their preparation are introduced.

15. Arrangements were made during the year for the manufacture at Roorkee of scales to measure exactly on the map the sides of the several square units of measurement in use in various districts, the object being to give the patwári his results directly without putting him to the necessity of a calculation in the case of every field he measured up. Satisfactory *paimánás* have been made, and district officers put into communication with Roorkee for their supply.

16. Special inquiries were made on the subject of cattle-breeding and the condition of the cultivator in parts of the Agra district, and of the fitness of the village records of Bulandshahr to serve as the basis for the revision of the revenue, and reports submitted to the Board.

17. The work of the staff in the following districts was personally inspected either by the Director or Mr. Darrah, and duplicate reports of the results of the inspection sent to the Collector and to the Board of Revenue :—

Aligarh.—In the one tahsíl inspected the work of the registrar-kanúngo was good. The supervisors had been rather remiss in their testing tours. Of the records of six villages tested on the spot, four were remarkably accurate and two were disfigured by fictitious entries. The staff was, as a rule, working well, and only a little attention was required to make it very good indeed.

Etah.—The work of every part of the staff was good. In seven out of nine villages inspected on the spot the *khasras* were remarkably free from error. The only defect noticed was that the patwáris were backward in writing up their village accounts.

Mainpuri.—The registers and diaries were well kept up, but the supervisor-kanúngos were late in commencing their testing tours. The entries in the *khasra* were very accurate, but the patwáris were generally in arrears with their *bahikhatas.*

Bulandshahr.—Every part of the work was up to date and very accurate. The sadr kanúngo was constantly on tour. The registers were often much in advance of the dates prescribed by the rules and in no case in arrears. The supervisor-kanúngos went on tour early and accomplished their field testings in time. The patwáris not only kept up all the papers required of them, but had nearly finished the revision of the old field maps handed down from the last settlement. The areas were surprisingly accurate and the percentage of error in other entries not high.

Moradabad.—The practice of employing kanúngos on work other than is allowed them by the rules had been discontinued, and some improvement was observed, but further progress is much to be desired. The percentage of non-resident patwáris in Amroha and Hasnpur was out of all proportion to what in any circumstances it should be necessary to allow. At the end of December hardly any one of them had commenced writing up his village accounts. The supervisors had begun their tours late and maintained them irregularly. The average number of days spent on tour by those of Hasnpur was only 26. Except in Hasnpur, the work of the registrar-kanúngo was fairly good, but there it was both inaccurate and in arrears. The sadr kanúngo, though he had been relieved from all extraneous work, had made no attempt to do his own. It was found necessary to fine some of the supervisors and to recommend the transfer of the registrar of Hasnpur.

Agra.—The patwáris' papers were generally accurate in all material particulars, though the accounts were backward. The supervisors were lax in their testing tours, and it was found necessary to recommend the dismissal of one of them.

Fatehpur.—The sadr kanúngo had been constantly on tour and with good results. The registrar's records were well kept up, and the only defect noticed was the short time given to testing tours by the supervisors The work on the whole was satisfactory.

Basti.—The registrars' records, though still in arrears, were far better written up than they had been in the year before. The supervisors had spent much more time on their testing tours, and the percentage of non-resident patwáris had been greatly reduced. The improvement on last year was very marked.

Etáwah.—The sadr kanúngo had been on tour and had subjected both the tahsíl records and the field work to an effective inspection. The registers were good and the village records remarkably accurate, except that the maps were not always brought up to date ; only in one case was dishonest work detected.

Jalaun.—The work had been carefully supervised by the tahsíldars and higher revenue officers, and was on the whole satisfactory. The village accounts were punctually kept up, and the *khasra* entries accurate. The only defects noticed were that the tahsíl registers were somewhat in arrears, and that there had been some negligence in correcting the village maps so as to bring them up to date.

Jhánsi.—The sadr kanúngo is past his work and can exercise no efficient supervision. His retirement has been recommended. The maps are perhaps worse than in any other district in the province except Basti and Gorakhpur, and little (if any) effort is made to correct them for annual alterations in the cultivation. At the orders of the Board the Deputy Commissioner has been invited to make special proposals for their improvement. There has been considerable laxity in allowing the appointment of minors and expecting that the work will be done by substitutes who draw only a fraction of the pay. An unusually large number of patwáris were found absent from their work, generally on long terms of leave.

Hamírpur.—The sadr kanúngo, Pandit Bishn Dat, had commenced his inspection tour on September 14th and, before the middle of March, had visited all the tahsíls, inspected the work of all the supervisors except one who was suspended, and had tested on the spot a large number of village papers. The work of every part of the establishment was excellent, the maps usually in fair order, and in some parts of the district absolutely accurate. In one tahsíl, out of a total number of 516 *khasra* entries tested, there were only seventeen errors and those of the most trifling description.

Cawnpore.—The work done by the patwáris was fairly good, and the supervisors had commenced their tours early and maintained them well. Some slight defects were found in the registrars' office and reported to the Collector.

Bánda.—Two main defects were noticed. In the first place, no attempt was made to keep the maps recently prepared for the settlement up to date. In the second, the supervisors generally spent too much time at the tahsíl and tested both *kharíf* and *rabi* entries in one tour in December and January. The rareness of double-cropped land makes the latter defect of comparatively small importance, but the omission to correct the maps is more serious. Correspondence with the Collector has shown that in only a third of the villages is there any difficulty in carrying out the work, and that in the majority of that third the difficulty is not formidable. Special attention has been promised to the subject during the ensuing cold weather. In all other respects the staff appeared to be working well.

Muzaffarnagar.—The patwáris here are a very superior class of men, generally Banias or Muhammadans; and the maps are admirably maintained, being traced every year from the map of the year before after corrections on the thin cloth known as *nainsukh* or *latta*. It was hardly possible to find a mistake. The sadr kanúngo showed much energy in supervising this important part of the work. The record-room is in excellent order, and the entries in the registers unusually detailed and accurate. The only point in which improvement was desired is the supervisors' testing tours, which in some cases were begun too late.

Meerut.—As in Muzaffarnagar, the correction of the maps was very well done, and the patwáris usually of a high class. The supervisors went on tour early and were well on with their testings both on the spot and of the filed papers. The tahsíl registers, except that a considerable number of mistakes in transcribing them in English was noticed, were good.

Bijnor.—The number of non-resident patwáris was high, and the cases where a man professed to reside himself while his family lived elsewhere frequent. The supervisors usually began their tours on or about the prescribed dates, but did not maintain them with sufficient continuity, often intermitting them in October and November. There was reason for suspecting the accuracy of the rents recorded in the tahsíl registers, but the areas appeared to be fairly accurate and the work was well up to date.

18. One result may be noted in this year's testings: in not a single district was the establishment found to be employed on other than their legitimate duties. Two years ago complaint was made of the innumerable miscellaneous kinds of work that were demanded of it. Last year some traces of the same irregularity were

noticed. Now, as far as can be judged from the kanungos' diaries, this state of things has altogether ceased to exist and the kanúngos and patwáris can devote their undivided time to the work they are paid to do. Except in two districts the results were satisfactory, and in some, such as all in the Meerut Division and Hamírpur, the most difficult part of the work, the annual correction of the maps, was done in a way which left little or nothing to be desired The most common defect was a backwardness in keeping up the village accounts.

19. Between April 1st, 1882, the date of last year's report, and October 1st, 1883, there have been eleven examinations of kanúngos in the North-Western Provinces. Two each at Meerut, Bareilly, Agra, Allahabad, and Benares, and one at Jhánsi. The total numbers examined were :—

	Examined.	Passed in all subjects.	Passed in some subjects	Failed.
Sadr kanúngos	5	2	3	...
Registrar kanúngos	72	21	25	26
Supervisor kanungos	222	118	62	42
Candidates	477	159	192	126
Total	776	300	282	194

20. The total strength of the staff at present employed in each district is shown in the annexed table :—

	Total number of kanúngos.	Total number passed.	Total number not passed.
Sadr kanungos	34	32	2
Registrar kanúngos	192	160	32
Supervisor kanúngos	432	390	42
Total	658	582	76

21. Immediately after his appointment to the Department, Major Pitcher held kanúngo examinations at Lucknow, Fyzabad, Sitapur, and Rae Bareli, with the results detailed below :—

	Examined.	Passed.	Failed.
Kanúngos	72	12	60
Candidates	520	154	366
Total	592	166	426

22. The revised code for the guidance of patwáris and kanúngos in Oudh was completed early in the year and issued by the Secretary to Government in the Oudh Revenue Department on 2nd April, 1883. In its main features it is identical with the revised rules for the North-Western Provinces, its principal difference being that the patwáris, instead of being paid monthly at the tahsíl, receive their salaries from the landlords, who receive an equivalent deduction from their land revenue. The direct supervision of the Oudh staff was entrusted to this Department by Circular No. 8-975R. of 1883.

23. During the camping season of 1882-83 Major Pitcher was mainly employed in aiding Major Erskine in the inquiry conducted by the latter officer into the working of the Oudh Rent Act; and while so employed he examined patwáris' papers and

kanúngos' work in the districts of Bara Banki, Sitapur, Lucknow, Rae Bareli, Partabgarh, Unao, and Hardoi. As a general rule the papers were found to be very reliable as records of rents and cultivation, but the state of the maps in the possession of patwáris in some districts leaves much to be desired. Where district officers, as in Bara Banki and Partabgarh, have recognised the great importance of this branch of their duties, the patwáris were duly provided with excellent maps, but in the remaining districts examined maps were generally the exception, and arrangements for curing the deficiency are under consideration.

24. In September, 1883 divisional examinations of Oudh kanúngos were again held with the following results :—

	Examined.	Passed.	Failed.
Kanúngos	103	14	89
Candidates	75	16	59
Total	178	30	148

25. The new supervising staff sanctioned for Oudh is being gradually organised with caution, and new forms of record are being carefully prepared. There is every reason to hope that in another year or two the records of agricultural statistics will have been drilled into a state of reliable efficiency.

SECTIONS II. AND III.—(*Blank.*)

SECTION IV.—MEASURES OF PROTECTION, INCLUDING ARBORICULTURE.

26. *Wells.*—During the past year a note by Captain Clibborn, Executive Engineer, who was on special duty in this Department from October, 1881, to August, 1882, has been submitted to Government. The note deals with the general subject of well irrigation in these provinces and gives the results of the experiments and observations made by Captain Clibborn during his cold-weather tour. The result is "probably the largest collection in existence of data for forming a judgment as to the probable areas that can be covered by wells of various dimensions, the depth of water required by various crops, the relative cost and efficiency of all the forms of lift in use, and a number of other points on which a clear understanding must be arrived at before the practical problem of well-sinking can be dealt with successfully."

27. *Áwa estate wells.*—The construction of these wells has remained in the charge of Mr. Wilson. A note on the subject, covering the period from the commencement of the work to September, 1882, was submitted to Government with Captain Clibborn's note. During the past year the progress made has been as follows :—

In the Jaithra circle 26 wells have been completed ; 18 of these—one 8 feet, two 5 feet and the rest 6 feet in diameter—are ordinary spring wells with the cylinders embedded in clay and obtaining their supply from the sandy stratum below ; 7 are percolation wells 6 feet in diameter, the steining below the water surface consisting chiefly of bricks laid dry, so that water may percolate through the joints ; and one 5 feet in diameter is an experimental percolation well, obtaining its supply from the bottom. Percolation wells have been built in places where trial borings had proved the mota to be at such a great depth below the water surface as to render the construction of spring wells too costly to be a financial success. Twenty-eight wells are in course of construction ; of these 14 will be ordinary spring wells ; 4, which are only 5 feet in diameter, will probably be percolation wells, obtaining their supply through a filter bed in the bottom, and 10 will be tube wells.

An experiment has been made with cast-iron tubes of the description specified in Mr. Wilson's note, but, as was partially anticipated, the joint is not stiff enough to permit the tubes to be forced through kankar. It has since been decided to use cast-iron pipes with wrought-iron covering hoops, and some of these pipes have been ordered and are daily expected. These pipes are of the kind commonly used in artesian wells at home, and there is no doubt that they can be sunk successfully through any stratum that will be encountered. They are expensive, and it was thought advisable before resorting to them to try the cheaper kind of pipe. Almost any kind of pipe, whether of earthenware, wood or iron, can be sunk through sand, but to force it through kankar or clay considerable pressure must be applied, and unless the joints are stiff enough they fail. Tube wells of this description may be said to be still on their trial, and it appears most important to show that such wells can be successfully constructed, and to ascertain the supply which they will yield. When these points are satisfactorily proved, further experiments may be made in the direction of reducing the cost of the tube.

When these wells were started, the great depths of sand which have been encountered without reaching clay—in some places over 115 feet below the water-level—were not anticipated. Unless tubes of a very cheap description can be used, only large wells can be a financial success in such places, and it is useless to build such wells until the water supply available is ascertained.

It is probable however that in places where the mota is over 60 or 70 feet deep, it will pay better to build percolation wells than spring tube wells. The former have been worked, but not sufficiently, and it is hoped that all that have been built will be thoroughly tried by the cultivators during the ensuing *rabi* season.

Most of the ordinary spring wells have been sunk about 20 feet in sand before reaching clay. The sinking in clay has proved very expensive, and dress-divers are now being employed, the diving apparatus having been kindly lent for the purpose by Major F. J. Home, R.E., Superintending Engineer of the 2nd Circle, Irrigation Works.

The boring tools have worked successfully. Altogether 103 trial borings have been made to a maximum depth of 42 feet and an average depth of 31 feet below the water surface. The total cost of labor has been Rs. 265-14-0, or Rs. 2-9-3 per boring. To this should be added about 9 annas, the cost of digging a *kachha* well to the water surface. Seven deep borings, costing Rs 248-2-3, have also been made, one to a depth of 115 feet and two others to depths exceeding 100 feet. The total cost of carriage and repairs of tools, ropes and oil, has been Rs. 335-1-0; and dividing this proportionately among the deep boring and the trial borings, the charges against each of the latter amount to Re. 1-11-0. Hence the total cost of a trial boring amounts to about Rs. 4-13-0. The construction of the sludge-pump has been improved, as those which were first made very soon required repairs. The charges for repairs include those for altering the tools, and are greater than they would now be.

The object of the trial borings is to ascertain whether a spring well or a percolation well should be made. The pipes are sunk to a maximum depth of 42 feet. If they reach mota within this depth, they are sunk a few feet into it, in order to ascertain if it is thick enough to support the cylinder of a well, and are then withdrawn.

In the Khwajapur circle 35 wells have been started, and of these 23 have been completely sunk, 18 to the first and 2 to the second mota; the remaining three will require pipes to reach the second mota, as it is too deep to admit of the cylinders being sunk to it.

Nine more wells have been sunk to the first mota, but the supply obtained from the sandy stratum below it has proved insufficient; eight of them will be sunk to the second mota and one will require a tube. No difficulty has been found in sinking these wells. There appears to be a continuous stratum of clay reaching from near the water level to a depth varying from 12 to 25 feet, and extending over the six villages

in which wells are being made. The cylinders are sunk through this by baling out the water and sending men down to dig out the clay. The stratum of sand or loam between the first and second layer of clay varies in thickness from 10 to 20 feet, and in sinking through this, Bull's dredger or the country *jham* is used. The chief difficulty experienced in the construction of wells at Khwajapur is to select the proper size of well to build in each site. In some places the first stratum of clay is underlaid by a thick layer of coarse sand, which gives ample supply for two buckets; in others the sand is very fine, or is replaced by loam, which does not give enough water for one bucket.

In some wells, before sinking to the second mota, four holes 3 inches square have been made in the cylinders at such a height above the curb that when the cylinders are completely sunk the holes will be level with the bottom of the first mota. The spring below the second mota will also be tapped, so that the wells will be supplied from two springs.

Trial borings have been made in Khwajapur in old *kachha* wells near the sites of new wells in order to find the depth to the second mota and the nature of the sand between the first and second clay strata. The average cost of a boring has been Rs. 14. The tools used are of the same description as those worked at Jaithra, but they do not work so satisfactorily owing to the prevalence of fine sand, loam, and clay.

28. *Khairagarh wells.*—The Settlement Officer of the Khairagarh pargana in the Agra district reported that owing to the nature of the strata, though there were 37,000 acres of dry cultivated land in the southern part of the pargana, there was no hope of building wells to irrigate more than 3,000 acres. This was stated to be due to two causes :—

(i.) In some places solid rock is reached either above the level of subsoil water or at a short depth below it, and its thickness is so great that wells sunk in it do not pay. The solid rock gives very little water, but if a stratum of loose friable rock is reached, a good supply may be obtained.

(ii.) In other places where rock was not encountered it was stated that wells could not be built owing to a substratum of quicksand, which "not only made it difficult to build up the cylinder, but, even if that were effected, would absorb the water as it flowed into the well and render it perfectly useless."

Mr. Wilson went over the pargana last April with Mr. Hamblin, the Assistant Magistrate of Agra, but could hear nothing about this quicksand. It appears, however, that in parts of the pargana a stratum of white clay (*dhor mati*) occurs below the water-level. This stratum is often of great thickness and in many places the cultivators have been unable to pierce it. It is reported too that as soon as this stratum is reached the water in the well disappears, so that the earth can be dug out dry. The clay is very hard and fine and probably does not yield water, but that it absorbs the water already in the well appears questionable. It is possible that the water first encountered may be shut out by the cylinder being sunk into the clay.

A sum of Rs. 1,000 has been sanctioned by Government for experiment in this pargana. Three wells have been selected :—

(i.) A well in Bhopur Jagner, where rock is found at a depth of 8 feet below the surface of the ground. A shaft 26 feet deep had been sunk in the rock, but when the well was inspected there were only 2 feet of water in it. In order to ascertain the cost of making a well in rock, arrangements have been made with the local well-sinkers to sink the shaft 20 feet, and the work is nearly completed. The cost of blasting and removing the rock comes to about Rs. 7 per foot, the diameter of the cistern being 8 feet. In the rent-rate report of the pargana, the cost of cutting and blasting the rock is estimated at Rs. 15-8 per foot.

(ii.) A well in Jagner, the shaft of which is 7 feet 2 inches in diameter and has been sunk about 24 feet in rock. There were 33 feet of water in the well in April, but the

well could be emptied in half a day by one bucket. It would be very expensive to sink the shaft any deeper, and it is proposed to bore a hole about 6 inches in diameter from the bottom of the shaft. Compared to the cost of deepening the shaft the cost of the boring will be comparatively small, and if a stratum of friable rock is reached, the supply in the well will be considerably increased. The boring tools are ready, and pipes for guiding the tool from the surface of the water to the bore hole have been procured. Work will be started as soon as the rains cease.

(iii.) A well in Sarhendi, 6 feet 6 inches in diameter, which was sunk about 28 years ago. The owners of the well said that the well had been sunk to the "*dhor mati*," which was reached at a depth of 18 feet below the water surface, and that a small shaft had been dug 27 feet in this clay without getting through it. The well can be emptied in a few hours by one bucket and is not used for irrigation. The well was cleared out, but it was found that the cylinder had not reached the clay stratum, but was still on sand. The depth to the clay was tried by driving an iron bar through the sand and was reported to be 4 feet below the bottom of the old cylinder. As the Magistrate of the district had made an agreement with the owner of the well by which the latter consented to allow his well to be used for the experiment, it was considered better to go on with the well than to select another. A small shaft was built in the well, but could not be sunk before the rain began, and work was then stopped. As soon as the rains cease, the small shaft will be sunk to the "*dhor mati*," and an attempt will be made to get through it. In some wells this clay has been pierced, and a fair supply of water has been obtained from the stratum below it.

The sum of Rs. 200 has been expended during the year on the wells in Bhopur Jagner and Sarhendi.

29. A full note by Mr. Wilson on the work done in connexion with the deterioration of the soil by *reh* is appended to this report (*Appendix I*).

The agricultural experiments are comprised under arboriculture, the growth of special crops, and subsoil drainage; the trials made under the heads of surface drainage, flushing, and manuring having been discontinued.

The area under plantations is 106 acres against 103·24 acres last year. No fresh land has been taken up, but trees have been planted in two plots with an area of 2·76 acres which had previously been dug to a depth of 3 feet.

During the rains of last year the plants which had died were replaced by *kikar* transplants, but though these have succeeded better than when the seed was sown *in situ*, there appears to be no doubt that *kikar* will not grow on any but the best *úsar*. Since the rains of last year work has been confined to planting out *chaunkar* (*Prosopis spicigera*), *reunja* (*Acacia leucophlœa*), and the Australian salt bush (*Atriplex nummularia*). The tap roots of *chaunkar* and *reunja* develope very rapidly; and in the first nursery of *chaunkar* that was started the plants were left too long, so that, though only 18 to 24 inches high, the roots were about 5 feet long, and the soil being very hard, it was hardly possible to remove them without injury.

A second nursery has lately been started, some delay having been caused by the seed that was in stock having become useless.

A nursery of *reunja* was formed in February, and the plants were put out in June and July, when they were from 9 to 12 inches high, the roots being from 24 to 30 inches long. Some time must be allowed before their success or failure can be told, but the fact that both *chaunkar* and *reunja*, unlike *kikar*, have no side roots appears strongly in their favour in *úsar* soil. It was ascertained by Mr. Buck when he visited Madras that *Acacia leucophlœa*, there called *vel velan*, had proved the best tree for the saline soil of that presidency.

The Australian salt bush appears a decided success, the five plants received last year being about 4 feet in height and looking very strong and healthy. There are

now 93 of these plants and 27 of a species of *Chenopodium* in the plantations. They were received from the Saháranpur Botanical Gardens, and all appear to be doing well. Mr. Duthie has written to Australia for a hundred weight of seed, and it is hoped that it will shortly be received, so that the plant may have a thorough trial.

The grass in the plantations is very thick, and arrangements have been made to cut it, make it into hay and stack it. The experimental cuttings show an increase in all the plots, but this may be partly due to the accumulation of dead grass of last year, which was cut with the fresh grass.

As requested by the Government of India in their review of last year's Administration Report, Mr. Wilson has given details of the condition of each plantation.

The experiment on the subsoil drainage plot has been continued, but with very little success.

30. So far as experiments on *úsar* have gone, they appear to show that the only way of reclaiming it at a reasonable cost, so as to make the land fit to grow ordinary crops, is to cover it with silt, and this can only be done in places where canal water is available at a sufficient level above the land. The utilisation of *úsar*, by growing such grasses and plants on it as thrive in a saline soil and can be used for fodder, appears much more likely to succeed.

31. Definite proposals have recently been submitted to Government for taking up a large area (100 square miles) of *úsar* and ravine land and preserving it for fuel and fodder reserves. For the present, at all events, it is not proposed to plant trees except where the grass shows the soil to be fit for them, the land in which *khar úsara* grows being kept entirely for grass. From careful estimates that have been made, it appears probable that the revenue obtained from sale of wood and grass will pay the interest charge on the outlay as well as the expenses of establishment and maintenance, and the indirect advantage that should accrue from the utilisation of land, a great part of which is now absolutely barren, will be considerable.

32. The survey of villages in the Akrabad pargana is nearly complete, only two out of the 65 villages remaining to be surveyed. Ten villages have been surveyed three times, and during the ensuing cold weather sufficient information will be available to enable a conclusion to be arrived at as to the increase or decrease of *reh* in these villages.

A drainage map of the tract has been prepared and an extensive series of water-level observations are in progress.

The *úsar* maps of the *Doab* districts have been corrected and completed. The Rohilkhand districts are also nearly completed.

33. A map showing the depth to the spring level throughout the provinces is in course of preparation, and will be of use both in the preparation of projects for well construction and to show how the distribution of *úsar* is affected by the depth to the subsoil water.

34. The experiments conducted at Áwa up to 1882 raised a strong presumption that by enclosing *úsar* land an increased supply of fodder grass would be obtained, which, if cut and sold instead of being grazed, would bring in a satisfactory return on the capital outlay. Sanction having been obtained and a grant of Rs. 2,000, two plots of land of 130 acres and 68 acres, respectively, were taken up in fairly close proximity to the city of Cawnpore. Up to date of report the expenditure in fencing and watching has amounted to Rs. 1,857. Operations were not fairly commenced till the end of the rains of 1882, by which time the grass had already been grazed down. This year the rains have been scanty and fitful. It is too early yet to say how far the scheme is likely to prove successful.

Irrigation from rivers by steam power.

35. *Project for irrigating Gházipur Tobacco Farm.*—In March, 1882, Messrs. Begg, Dunlop and Co., the lessees of the Gházipur Farm, in a letter to the Secretary

to the Government of India, Revenue and Agricultural Department, stated that their land suffered much from the want of a permanent water-supply. Considerable capital had been expended on the construction of wells, but, owing to the depth of the water below the surface of the ground and the scanty supply available, had proved quite inadequate to secure protection against drought, and they did not feel justified in incurring further expenditure in that direction. They wished therefore to try the experiment of raising water by steam power direct from the Ganges, and, as there was some doubt as to whether or no the project would pay, they enquired if Government could let them have the use of a steam pump for two or three years.

A copy of the letter was sent to the Government of these provinces, and by them forwarded to this Department for opinion and report.

Mr. Benett replied that the only steam engines at his disposal were those attached to the steam plough, and, the latter being no longer required at Bánda, recommended that the engines should be inspected by the firm, who should be asked to submit an estimate showing the grounds they had for supposing that the engines could be used at Gházipur with a reasonable prospect of success. In the event of the report proving favourable, it was recommended that the engines should be lent to the firm free of cost for two years, the firm paying for the whole cost of maintenance, repairs, and establishment, and for all damage other than that caused by fair wear and tear. The firm were to allow the fullest opportunities for inspection, and to provide all facts connected with the working of the engines that might be required of them, so that the experiment might be of assistance in the preparation of other projects of a similar kind.

36. The sanction of Government to these proposals was conveyed to Messrs. Begg, Dunlop and Co. in July.

In the meantime the firm had addressed the Government of these provinces, requesting that an Engineer of the Irrigation Department should be deputed to visit Gházipur and report fully on the scheme of irrigation which it was proposed to carry out.

37. Captain Clibborn, the officer deputed for this work, visited the Farm in November and has since submitted a report, of which the following are the salient points :—

The area which it is proposed to irrigate is 675 acres, assumed to be under the following crops—

Wheat	200 acres.
Tobacco	300 „
Sugarcane	175 „

It is calculated that if the pumps discharge a little over five cubic feet per second, they will be able to irrigate the wheat and tobacco in 90 days of 12 hours each.

The most important part of the expenditure in steam pumping is the cost of the fuel consumed, and this varies very greatly in different engines. The most economical engines used in the water-works in England consume less than 2lb. of English coal per hour per horse-power measured by the water actually raised.

A 25 HP high-pressure engine in the locomotive shops of the East Indian Railway at Allahabad consumes 35lb. of Indian coal per horse-power per hour.

Captain Clibborn allows 20lb. of coal per horse-power per hour. The price of coal being eight annas per maund and the mean height of lift 45 feet, it is calculated that the cost of the coal required to raise 1,000 cubic feet of water will be 2·84 annas. The cost of the subordinate establishment, small stores and repairs, are estimated at one-fourth of the cost of the fuel. Hence the total cost of fuel, small stores, repairs, and subordinate establishment comes to 3·55 annas per 1,000 cubic feet of water lifted.

It appears that in the cold weather there are 700 feet of sandy river bed between the stream and the bhangar cliff. It would be difficult to convey the water of the river across this, and, instead of attempting to do so, Captain Clibborn proposes to sink

a well on the highland, and hopes to reach a clay stratum, by piercing which the required discharge of five cubic feet per second may be obtained.

38. It is recommended that three of Tangye's 14-inch special steam pumps with 26-inch steam cylinders should be procured. The total cost of engines and boilers at Gházipur is estimated at Rs. 27,000.

The total estimated cost of machinery, masonry works, and distributary channels, with interest at 4 per cent. for one year during construction, is estimated at Rs. 34,320.

The annual expenses, not including working, are estimated as follows :—

	Rs.
Interest on Rs. 34,320 at 4 per cent.	1,373
Depreciation, wear and tear and repairs of machinery at 5 per cent. on Rs. 27,000	1,350
Repairs to channels at 10 per cent. on Rs. 3,000	300
Establishment	420
Rent of land for pumping station	20
Total, ...	3 463

This is at the rate of Rs. 5·1 per acre. The following table gives the estimated cost of irrigating an acre of each of the three crops by steam power (including cost of fuel, &c.), and by cattle power from wells:—

Crop.	By steam power.	By cattle power.
	Rs. a. p.	Rs. a. p.
Wheat	6 6 0	14 12 0
Tobacco	8 0 0	17 6 0
Sugarcane	13 8 0	25 6 0

39. The report has been sent to Messrs. Begg, Dunlop and Co., who have been asked to submit any proposals which they may have to make on the subject.

40. In January, 1883, Mr. Wilson was directed to inspect and report on the Behti Tal estate in the Partabgarh district, Oudh, where large drainage and irrigation works are being carried out by Captain F. Chapman, with a view to ascertaining how far in that case steam power for the distribution of water could favourably compare with canal distribution. A full report has been submitted to Government, of which the following is a brief abstract :—

Captain Chapman has acquired the lease of some villages in the Partabgarh district on the banks of the Ganges. About 7,000 acres of land were flooded annually by the Ganges river, and at the end of December water remained on about 3,000 acres which was known as Behti Tal. Captain Chapman has reclaimed this land by making a strong "*band*" to keep out the flood water, and has procured machinery for pumping out surplus water during and after the rains. In the dry weather the same machinery is used for pumping water from the Ganges and watering the land, affording the only example of irrigation by steam power in these provinces. There are two pumping stations, one at Bhalipur for the drainage, and the other at Shahpur—close to a high bluff at the foot of which the Ganges runs—for irrigation. The pumping power consists of four 12-horse power portable engines and the same number of 15-inch centrifugal pumps. Coal has been used as fuel, but very seldom; dry grass has also been used, but did not prove satisfactory. Faggots of *jhau*, obtained from some *kachhár* land on the estate, are now used. The height of lift in the cold season is 12½ feet, and the water raised is delivered into what Captain Chapman calls the girdle drain, which is really an annular tank dug round the 3,000 bighas of land which are to be irrigated, and from this drain it is raised by the cultivators by baskets.

Owing to the favourable cold-weather rains no irrigation was done during the past *rabi* season; and in February, when the place was visited by Mr. Wilson and by the

Assistant Director for Oudh, the pumps were not at work, and they were therefore unable to test the working of the engines. This is the less to be regretted, as experiments made in the short time that was at their disposal would have had little practical value. The area irrigated is large, and the distance of different fields from the pumping station varies so greatly that accurate results can only be arrived at from a daily record extending over a whole season.

Captain Chapman, however, kindly furnished some information as to the quantity of coal and cost of the *jhau* faggots consumed and the area irrigated, which, allowing 4 inches for the depth of a watering, including the loss in the irrigation channels, appears to agree very well with what is known of the working of similar engines, the consumption of coal per effective horse-power given off by the engine being about 10lb. per hour. In years of average rainfall the pumping power is ample, but in the event of a failure of the rains it will be necessary to work the engines day and night to irrigate the large area, 1,000 bighas, which it is proposed to put under rice. The total cost of the pumping machinery landed at Behti was about Rs. 46,300, and the cost of irrigation channels and masonry works when completed is estimated at Rs. 12,800.

The annual cost of irrigation may be divided into two parts, the first of which may be considered constant, while the second is dependent on the number of waterings given to the crops. The former includes the interest charges on capital outlay, charges for repairs and maintenance of works and for repairs and depreciation of machinery, and the cost of the permanent establishment; and the latter consists of the cost of fuel consumed and of the temporary establishment employed while the engines are working.

Making the usual allowances for repairs, &c., the fixed charges are calculated at Rs. 5·05 per acre, and the variable charges at Rs. 0·95, or Rs. 0·30 per watering according as coal or *jhau* is used for fuel. Three of the engines and pumps are required for drainage purposes during the rains, so that a great part of the fixed charges would be incurred if the pumps were not used for irrigation. Allowing for this, the cost of irrigating an acre of land in a year of average rainfall, using *jhau* faggots as fuel, appears to be about Rs. 4 per acre for the two *fasls*.

An estimate is given of the cost of irrigating the land by means of stationary engines with compound cylinders, and it is shown that if irrigation alone had been the object, a saving of from Rs. 24 to Rs. 30 per cent. would have been effected. But, as Captain Chapman requires both to drain and irrigate the land, portable engines probably prove the more economical at Behti.

The most interesting point in connection with irrigation by steam power is a comparison of its cost with that of canal irrigation. The latter involves a heavy first cost, but the charges for establishment and maintenance are very low, only 2½ per cent. on the capital outlay in the case of the two largest canals in these provinces. The first cost of the former may be less; but, owing to the heavy charges for repairs and depreciation of machinery and the high cost of coal, it is shown that, even with the low lift of 12½ feet, there is not much prospect of bringing the total cost per acre of irrigation by steam power below the cost of canal irrigation.

41. In March last Mr. Wilson visited the court of wards' estate in Etáwah district in company with the Collector, with the view of suggesting measures of protection and agricultural improvements, and the following is an abstract of his notes :—

Barai estate.—In some of the villages of this estate, which are among the Jumna ravines, the depth to the water-level is too great to make the construction of masonry wells for irrigation directly a financial success. But cattle must be kept for ploughing, and though the area irrigable by a pair of bullocks may be very small, the existence of a good *pukka* well will cause a few fields of sugarcane or of *kachhiana* to be sown, and so indirectly benefit both the cultivator and the zamindár. It was proposed to construct

two wells, 9 feet in diameter, in places where the depth to the sub-soil water is nearly 100 feet, and the earthen shafts were dug to the water-level some years ago. The sub-soil consists chiefly of clay and loam with occasional thin beds of sand ; the supply obtainable from a well in such soil is scanty, and it is recommended that the wells be made 6 feet in diameter instead of 9 feet. The only way in which the cost of these wells can be kept down is by reducing the thickness of the steining as much as possible, and 15 inches for the lower part of the cylinder which is to be sunk, and 10 inches for the upper part is considered sufficient. The estimated cost of the wells is Rs. 720.

It is also proposed to deepen and repair an old *pukka* well in Khaitoli.

The only villages of the estate that were visited in which the construction of a number of wells appears feasible are Ayana and Katgarah Zunardar. In the former the depth to the water surface is from 25 to 55 feet, and in the latter from 15 to 30 feet. As in the villages among the ravines, clay and loam prevail in the sub-soil. The *kachha* wells are generally fed either by percolation or by side springs (*bera*). It appears probable that percolation wells will prove most suitable in such soils, as they would obtain their supply from each of the sandy beds which are passed through. But to start with it is recommended that two ordinary masonry wells, 5 feet in diameter, be built, in order to ascertain the quantity of water obtainable from such wells.

The Ayana distributary of the Bhognipur branch of the Lower Ganges Canal terminates at the boundary of Ayana village, and it would be a great advantage to have the channel carried on another mile at the expense of the estate.

In Pachdeora there is a ravine with an area of about 35 acres. About 7 years ago a *bund* was thrown across the mouth, which is less than 100 feet wide, but it was carried away in the rains of 1879. It is proposed to remake the *bund*, providing a channel at the side for escape water. After a few years the irregularities in the bed of the ravine should be silted up, and the land, which is now unculturable, should become of considerable value.

There is a large area of waste land among the ravines which might be advantageously planted with *chaunkar*, *reunja*, and *kikar*.

42. *Malhajani estate.*—The villages of this estate which were visited lie on the Bhognipur Branch of the Lower Ganges Canal, but do not get canal water, as there is no distributary near them. In a great part of the villages *kachha* wells can be cheaply and easily made, but in about half of Birampur and in naglas Holasi and Bishan of Malhajani village there is very little irrigation. It is proposed to build one well in each of these places. The depth to the water-level at the sites chosen is between 20 and 30 feet. There are more good sites for wells, but it is advisable to begin with these to ascertain the nature of the strata and the probable supply available. Many of the wells in the neighbourhood appear to yield a good supply of water. It is proposed also to repair three old wells.

43. *Partab Chand's estate in the Allahabad district.*—At the request of the Board of Revenue Mr. Wilson visited some of the villages of this estate in February, and the following is an abstract of his report :—

An embankment round some rice lands in Pura Gobai promises to pay a good interest on the outlay, and its construction is recommended.

In the village of Tela adjoining the Ganges some ravines have cut back considerably during the last few years. Up to about 15 years ago the land was uncultivated and covered with *sarpat* grass and bushes which protected it from erosion, but since the land has been brought under the plough, denudation has increased considerably, and in the rains of 1882 about 3 bighas of good land became unculturable.

It had been proposed to make a strong *bund* on the highland along the edge of the ravine, with two masonry outlets for the escape of the water that would

accumulate during heavy rain. Such a *bund* would prevent denudation so long as it remained intact, but the erosive action at the outlets would be very great, and it is probable that considerable expense would have to be incurred in building and protecting them. Instead of this it is suggested that the drainage water may be kept from accumulating by raising small ridges round each field from which the water flows into the ravine. The soil being a light loam, the rain which falls would be quickly absorbed.

The construction of two new wells and the deepening and repairs of three old ones is recommended.

It was proposed to spend the large sum of Rs. 10,190 on digging two new tanks and deepening four old ones. If the Benares Branch of the Sardah Canal is constructed, the villages in which tanks are situated will probably get canal water, and it is not advisable to incur heavy expenditure on irrigation works while the canal project is pending. In any case, one of the proposed sites is unsuitable owing to the sandy character of the subsoil, and to the level of water being near the surface of the ground. In the other sites the subsoil is suitable and the depth to the water-level from 50 to 60 feet.

44. Mr. Wilson embodied the results of his inquiries into tank irrigation in a note, in which the cost of excavation, the area irrigable, and the probable yearly income are discussed. The data available are quite insufficient to enable a reliable opinion on the subject to be formed, but it appears probable that if arrangements can be made with the cultivators to clear out the tanks every year, so as to maintain their capacity, the revenue should pay a fair interest on the outlay.

As it would be an easy matter in some districts to obtain accurate statistics as to the area irrigated from a number of tanks, the note was circulated to all Collectors, and it is hoped that after a few years some information which will prove of considerable value will be obtained.

45. The Department was enabled during the year to assist officers in charge of court of wards' estates materially in procuring for them improved sand dredgers: 15 dredgers being thus distributed. A want which with the present great expansion of well-sinking is beginning to be much felt is that of competent and responsible men either to take contracts or to superintend intelligently and with knowledge the construction of wells. Three urgent applications for competent men have lately been received from Oudh officers, but it has only been found possible to satisfy one.

Arboriculture.

46. The expenditure during the past year is shown below with the totals of the previous year in comparison :—

Divisions.	On groves.			On nurseries.			On avenues.			On lopping and felling.			Total, 1882-83.			Total, 1881-82.		
	Rs.	a.	p.	Rs.	a.	p.	Rs.	a.	p.	Rs.	a.	p.	Rs	a.	p.	Rs.	a.	p.
Meerut ...	202	5	6	696	2	10	7,921	7	11	157	12	6	8,977	12	9	7,006	4	7
Rohilkhand ...	102	13	0	856	12	7	5,754	8	3	138	15	10	6,853	1	8	4 892	15	8
Agra ...	60	0	0	1,923	1	1	8,102	12	11	123	13	6	10,209	11	6	5,759	15	5
Allahabad ...	398	9	6	1,333	13	10	7,342	6	5	314	2	6	9,389	0	3	7,898	4	6
Benares ...	474	8	1	763	7	5	4,088	13	4	56	3	3	5,383	0	1	5,464	13	2
Jhánsi ...	428	0	9	661	0	3	8,205	4	0	84	10	0	9,378	15	0	9,087	7	10
Kumaun ...	...			310	0	0	178	4	0	...			488	4	0	500	0	0
Lucknow ...	...			809	5	11	1,563	9	10	213	1	6	2,586	1	3	2,450	0	10
Fyzabad ...	...			223	15	1	1,656	12	6	...			1,880	11	7	1,078	10	3
Sitapur ...	54	0	0	189	5	1	1,754	4	5	37	1	3	2,034	10	9	1,375	10	4
Rae Bareli ...	...			218	4	9	1,558	1	0	42	0	0	1,818	5	9	1,380	5	7
Total ...	1,720	4	10	7,985	4	10	48,126	4	7	1,167	12	4	58,999	10	7	46,892	8	9

and the income realised is shown below with the totals in comparison :—

Divisions.	From felling.			From lopping.			From fruit			From other sources.			Total, 1882-83.			Total, 1881-82.		
	Rs	a.	p	Rs.	a.	p.	Rs.	a.	p	Rs.	a	p	Rs.	a.	p.	Rs.	a.	p.
Meerut ...	8,075	13	7	2,506	2	9	845	13	2	13	0	0	11,440	13	6	14,203	14	2
Rohilkhand ...	2,8[illegible]0	4	0	580	14	10	189	15	9	305	14	6	3,877	1	1	2,520	1	9
Agra ...	2,5[illegible]3	3	0	800	14	9	441	4	6	73	11	9	3,839	2	0	4,915	13	10
Allahabad ...	1,401	5	3	1,685	6	5	722	10	6	159	10	6	3,962	0	8	7,996	2	2
Benares ...	1,091	15	0	1,573	4	9	1,283	2	9	738	0	7	4,686	7	1	3,857	4	1
Jhansi ...	69	8	10	237	1	6	87	15	8	10	1	5	404	11	5	404	3	0
Kumaun ...	...			...			.			...			...			...		
Lucknow ...	1,762	8	3	491	14	6	45	2	3	54	0	9	2,353	9	0	395	12	4
Fyzabad ...	69	7	6	11	8	0	21	15	0	54	7	0	157	5	6	66	7	9
Sitapur ...	92	10	6	107	4	3	14	0	0	34	8	0	188	6	9	332	14	9
Rae Bareli ...	352	2	10	277	2	0	128	6	8	19	9	9	777	5	3	504	12	3
Total ...	18,178	14	9	8,271	9	9	3,780	6	3	1,455	15	6	31,686	14	3	35,197	6	1

47. It will thus appear that the expenditure was greater and the receipts less than in the previous year. The figures of divisions are liable to great fluctuations on account of storms which bring in a large income by windfalls one year, and in the succeeding year call for increased expenditure to fill up gaps. At the same time vigilant attention to the subject of arboriculture on the part of those district officers who will interest themselves in it produces quite as surprising fluctuations in income and expenditure as the storms.

48. The Government grant was Rs. 67,000 against Rs. 53,300 in the previous year, which, deducting receipts, leaves a net cost of Rs. 27,312-12-4 against Rs. 11,695-2-1. Planting out however fairly kept pace with expenditure.

49. The following table shows the lengths of road under continued operation and the lengths newly taken up :—

Name of division.	*Under operation.*		*Newly taken up.*		*Cost.*					
	1881-82	1882-83.	1881-82.	1882-83.	1881-82.			1882-83.		
	Miles.	Miles	Miles.	Miles.	Rs	a.	p.	Rs.	a.	p.
Meerut	172¼	180	28½	127¾	6 149	9	6	7,921	7	11
Rohilkhand	128⅝	109⅝	26¾	46⅝	3 873	11	2	5,754	8	3
Agra	138½	194½	50	195⅝	4,541	15	7	8,102	12	11
Allahabad	260½	185	48¼	47½	6,265	8	9	7,342	6	5
Benares	153	121	122	100¾	2,639	11	4	4,088	13	4
Jhánsi	164½	181¼	68	23¼	7,772	0	7	8,205	4	0
Kumaun	19½	19½	0½	10	155	0	0	178	4	0
Lucknow	34¼	23	6¾	18	1,538	3	7	1,563	9	10
Fyzabad	126½	57	56	42½	877	15	0	1,656	12	6
Sitapur	60½	80¼	3	11¼	1 210	1	10	1,754	4	5
Rae Bareli	82	75	33	1½	927	4	5	1,558	1	[illegible]
Total	1,340½	1,226½	442¾	624½	35,981	1	9	48,126	4	7

and the following statement shows a very large increase in the number of trees planted out as compared with the number planted out in the previous year :—

Name of tree.	1881-82.	1882-83.
Mango	25,574	37,840
Jáman	17,068	23,956
Ficus	7,565	8,021
Shisham	10,071	16,259
Nim	10,251	10,912
Tamarind	1,495	2,241
Mahua	5,838	6,129
Jack or barhal	1,767	1,215
Miscellaneous— Babul, bel, ber, jand, tendu, chiraunji, &c, &c.	15,446	23,229
Total	95,075	1,29,302

50. The following statement shows the nurseries and their cost:—

Name of division.	Number of nurseries	Number of trees at end of the year 1882-83.	Cost of maintenance.
			Rs a. p.
Meerut ...	12	29,513	696 2 10
Rohilkhand	16	31,465	856 12 7
Agra ..	29	78,294	1,923 1 1
Allahabad	35	48,168	1 333 13 10
Benares	30	30 831	763 7 5
Jhánsi ...	8	15,626	661 0 3
Kumaun	7	10,387	310 0 0
Lucknow	8	36,954	809 5 11
Fyzabad	8	9,868	223 15 1
Sitapur ..	9	7 681	189 5 1
Rae Bareli	4	8,798	218 4 9
Total	166	30,5,585	7,985 4 10

51. The following statement gives the extent of grove area:—

Name of division.	Number of groves.	Area of grove in acres	Number of plants	Cost of planting and maintenance.
		A. r p.		Rs a. p.
Meerut ...	3	35 0 15	100	202 5 6
Rohilkhand	4	3 3 33	1:2	102 13 0
Agra ...	5	1 0 24	56	60 0 0
Allahabad	2	2 0 0	238	308 9 6
Benares ...	3	22 0 32	27	474 8 1
Jhánsi ...	14	43 0 30	592	428 0 9
Kumaun ...	...	...	...	...
Lucknow ...	...	...	...	...
Fyzabad ...	...	...	...	...
Sitapur ... } Rae Bareli }	2	0 1 0	231	54 0 0
Total	33	107 3 14	1,356	1,720 4 10

The exclusion of a large area of 209 acres erroneously shown in the return from Sahâranpur last year explains an apparent falling off.

52. The receipts from fruit declined by Rs. 1,274, of which Rs 1,115 were due to the Benares Division alone. The year was a very poor one for mangoes; sales generally were effected at very low rates, and the decrease is probably accidental.

53. Efforts to enlist the co-operation of landowners in planting up avenues were maintained with the following results :—

In Etâwah 13,000 trees out of 15,000 were planted by private means.

In Bareilly, Lala Damodar Das, whose conduct in this connection was favourably brought to the notice of Government last year, is again reported by the Collector as having done excellent work. Munshi Narotam Singh has planted out 1¾ miles of the Bareilly-Bisalpur road, and 10 miles of the Bareilly-Naini Tal road have been planted through the united efforts of Lala Lalji Mal, Koer Lal Bahadur, Rae Kanhya Lal, Babu Ram Sarup, and Lala Lalta Parshad. The credit of organising these efforts is due to Mr. McConaghey, C.S.

In Azamgarh 15 out of 18 miles were planted out by zamindârs.

In Ghâzipur about half the planting in the district was effected by the zamindars themselves.

In the Kheri district, 5,726 *thalas* were constructed and 2,817 trees were planted on 57 miles of road by landholders, amongst whom Rája Krishen Dat Singh and Rája Amir Husain, Khan Bahadur, together planted out upwards of 650 trees.

54. But this record takes account of the tree-planting on avenues only, and little account of the large area brought annually by landholders under groves. The Assistant Director for Oudh during his cold-weather tour observed that, apparently, the number of new groves was far greater than the number to be seen under the axe, and it was found that *malis* from Lucknow and Fyzabad made regular tours into remote parganas, at the close of the rainy season, with good mango grafts and fruit trees for sale. It was also found that much of the opposition to avenue-planting takes its rise in the amount of rent-paying land thrown out of cultivation by the shade cast upon it, particularly when the public road may happen to run through the *gauhán*, or the most highly-manured land, of a village.

55. In the report for last year it was mentioned that the central arboricultural nursery at Lucknow had failed in fulfilling its object owing to the disinclination of natives to purchase any but valuable fruit trees, or to take for groves other than fruit trees. District officers objected to the expense of transit, and it was determined to close the nursery ; but, as already elsewhere stated, leave to take trees gratis was widely circulated in the neighbourhood. The result was that the mangoes and *mahuas* were quickly cleared out : *jámun* and tamarind have been taken in large numbers this year. Benefiting by the experience so obtained, it has been determined to maintain at least 20,000 selected mango seedlings for free distribution annually. It may be mentioned that the authorities of the Oudh and Rohilkhand Railway Company have lately made a very generous concession in agreeing to convey all plants distributed from the Lucknow Horticultural Gardens to all public gardens or institutions at one-fourth of the lowest rate hitherto charged on such consignments.

56. Circulars were issued during the cold weather, and again at the commencement of the rains, offering the surplus stocks of fruit and of avenue trees from the Saháranpur gardens, some free and others at much reduced rates.

57. In the matter of fencing there appears to be no novelty to report. The modes of fencing are almost as many in variety as there are districts, and each has some local difference in its favour. In one district thorns are cheap, in another the soil is sandy and *thalas* will not stand, while in a third aloes flourish and make a cheap living fence.

58. *Irrigation.*—The gourd-shaped *ghara* introduced by Mr. Twigg has been further improved upon by applying two coats of coal-tar, sun dried at intervals of a month, to the outer surface of the vessel, save where adjacent to the roots of the plant. On one short length of road in the Lalitpur district it was found that porcupines resorted to the *gharas* for water and caused such damage in their efforts to get at them that the *gharas* had to be given up.

59. The cost of nurseries is considerable, and a point raised by the Collector of Mazaffarnagar will be commended to the attention of district officers, *viz.*, whether in many districts young trees cannot be obtained at a reasonable rate from *malis* and zamindárs Seedlings of the fig tribe can certainly be found in most localities growing wild. Whether as shade trees, or as useful in famine time for the leaf fodder afforded, the fig tribe are probably the best of all trees for avenue purposes. Nurseries might ordinarily be maintained solely for the free distribution to all comers of mango seedlings.

SECTION V.—AGRICULTURAL EXPERIMENTS, INCLUDING FARMS.

60. The Cawnpore experimental station was continued throughout the period under report. The *rabi* of 1882 was realised under the superintendence of Mr. Fuller, who also planned, in the main, the experiments for the *kharíf* of 1882. The reaping

of the latter as well as the reaping of the *rabi* of 1883 was carried out by the Superintendent, Babu Lachman Parshad, Burma, under the general supervision of Major Pitcher. The *kharif* for 1883 was well forward before the commencement of this report.

61. From the two *rabi* crops further and most useful information was gained as to the value of various manures. In particular the high value of easily soluble nitrogenous manures for wheat crops was demonstrated in figures bearing closely on those obtained at much about the same period in England. Tables showing the cost of the various manures obtainable and the pecuniary returns resulting from their use are being gradually formed, which, while demonstrating, it is to be hoped, the high value of some manurial substances, such as leguminous crops ploughed in green, &c., which have hitherto been applied in a fitful sort of way, may also do good service in averting imposition on the cultivator of unremunerative remedies for infertility.

62. Experiments on deep and shallow ploughing, canal water *versus* well water, drill sowing *versus* broadcast, early ploughing after early rains *versus* neglect of opportunities, and on the relative value of one or more waterings during a season, were carried out with wheat and cotton. These experiments will be continued so long as any germs of value may present themselves, until the tabular results cover such a number of seasons as to command respect by a continuity of corresponding averages.

63. Prominent results may be thus summarised:—

The highest yields were for the *rabi* 2,181lb. of wheat per acre from a plot manured with saltpetre, and 2055·75lb. of wheat per acre from a plot manured with saltpetre and bone-dust.

	Rs.	a.	p.
Cost of manure (saltpetre) per acre	7	8	0
Value of produce resulting from the use of that manure ...	75	11	6
Cost of manure (saltpetre and bone-dust)	12	0	0
Value of produce resulting therefrom	71	15	10

American cotton was again a success, realising in the local market Rs. 46 per acre against Rs. 35 per acre, the price realised from an equally fine crop of country cotton.

The country cotton gave the heaviest yield, but the local mills gladly gave for the longer stapled cotton a more remunerative price.

In former years efforts were directed by Government to growing American cotton in India to compete at Liverpool with American-grown cotton, under the greatest disadvantages to Indian-grown cotton as regards freights, and were unsuccessful. But with the machinery brought, so to speak, to the cotton-field, matters are changed, and the feasibility of growing long-stapled occidental cottons successfully seems fairly assured.

64. The general interest awakened in *kháki*, or rather fawn-coloured cotton in connection with army clothing, has led to its being cultivated at the farm on a somewhat extended scale. A small quantity of that grown in 1882 was spun into cloth which is now under trial. About 20 maunds of seed were distributed for the *kharif* of 1883-84, and some 15 acres of the farm lands have been sown with it this year in view of more extended experiments.

65. Cape oats were again a success, yielding 2,026lb. per acre, and have been greatly in demand for seed.

66. The vast exports of wheat, which show every sign of multiplying, must gradually force attention to two points amongst many in connection with that trade. One is the renovation of wheat soils by the provision of cheap manures, which will nurse fertility and not simply exhaust it. Another is the improvement by selection of seed wheat. Both of these objects are being kept in view at the farm.

In April last a gentleman farming a large estate in the Sháhjahánpur district wrote before the *rabi* was ripe as follows:—" I shall be much obliged if you will kindly procure for me one hundred maunds of Muzaffarnagar white wheat for seed.

In August, 1881, you sent me 50 maunds. I had great difficulty in getting the cultivators to sow it and had to sow most of it myself; however, the cultivators now see that it is much superior in quality and outturn to the ordinary red kind grown about here. I had no difficulty in getting all I had sown last season, and the present crops over 200 bigahs are very promising, most of which will be kept for seed."

It is this same white wheat that is sown at the farm and is now every year carefully sampled for distribution. No wheat was found at any of the agricultural shows during the past year which excelled it in quality.

67. During the *kharif* of 1882 the successful manufacture for the first time of marketable sugar from the juice of *Sorghum saccharatum* was achieved. It is only during the past three years that anything but syrup has been realised from sorghum in America, and one factory alone turned out last year 319,944lb. of sorghum sugar. A good supply of fresh seed of the best sugar-producing sorghums has lately been obtained from America, and a very large area of the crop from such seed is now standing, which promises, from the first assays, to give better results than were obtained last year.

68. Ensilage also formed an experiment on the farm for the *kharif* of 1882, and for the first time in India, it is believed, was so far successful that fodder stored green in September was taken out in May and was eaten readily by cattle. Silos are this year to be found all over the provinces, and our information regarding their adaptability to Indian requirements should be greatly added to by next hot season.

69. *Lucknow Farm.*—A branch farm on a small scale was started at Lucknow in August, 1882, in which it was intended to illustrate such implements and agricultural experiments as had been found to answer at Cawnpore. Mr. Ridley was placed in charge. The site however, the only one at the time available, was altogether unfavourable, being that part of the arboricultural nursery from which immense numbers of young trees had but lately been removed. One thing was clearly proved, if indeed it needed proving, to wit, the inconclusive character of experiments conducted on unprepared soil.

Very satisfactory results, however, were obtained from some plots of fodder crops.

Oats and barley were cut over green just before coming into flower and were then allowed to run to seed before being again cut. Mangel-wurzel plants were in one plot stripped of their lower leaves, as the latter began to fade for a period extending from January to March, the leaves being used for fodder, while in another plot the leaves were left on the plant to fade. White Belgian carrots were also tried in competition with the mangels. The results went to establish that oats and barley were more remunerative in total yield when left alone, but a scarcity of forage during January and February might still desiderate the system of cutting over. Mangel-wurzel justified the high character which it holds with the wise few who cultivate it. It gave fodder continuously from January to the end of May, and yielded 777 maunds per acre of roots alone, and 980 maunds 34 seers per acre of roots and succulent leaves together.

This station was closed in July, 1883, under orders from Government.

70. *Agricultural implements.*—Improved ploughs were sold in larger numbers than hitherto; 681 Kaisar and 31 Watts having been disposed of. A simple addition was made to the ordinary native plough which is now under trial, and which so far appears to find great favor.

The chain water-lift introduced by Mr. Fuller was still further improved, and may now be considered a formidable competitor at low lifts to the swing baskets hitherto unapproachable for simplicity and economy : 46 of these were sold during the year.

The winnower has somewhat disappointed expectations, but is receiving continued attention.

71. Noticeable among the machinery imported was a hand thresher, by which, allowing liberally for all capital charges, it was shown that at a cost of Rs. 40·89 p

cultivator could in 12·5 days place the produce of 15 acres of wheat on the market, where under the native method it would take 107 days, at a cost of Rs. 41·5, to prepare for sale a like amount of produce. Moreover, by the hand machine there is a great saving in the labour of winnowing, and the wheat is delivered free from the earthy admixtures which under the process of being trod out is so frequent an accusation against Indian produce.

These are matters which in the great prospect opening out for Indian wheat should attract attention.

72. Another promising success was the introduction for sugar-boiling of an evaporating pan on the American principle. It has yet to stand the test of wear and time. The results summarised were that *ráb* or undrained sugar of most superior quality was made at a cost of 12 annas 9 pie per maund against Re. 1-1-10 when made by the cheapest native process. Further, in the case of the native process skilled sugar-boilers have to be employed, whereas the use of the evaporator is quickly learnt by any coolie. And the advantages are that it will work off the produce of a field in less than half the time occupied in the native process, or as 177½ is to 83, and that it can be carried about from field to field, saving time and expense in the cartage of cane. Time saved is a great advantage, since the longer the cane remains unpressed after cutting or the juice remains unboiled, the greater the inversion of crystallisable sugar into uncrystallisable glucose.

73. A maize-shelling machine was also procured which acts admirably, and is cheaper than the cheapest form of hand-shelling as ·77 to 1·58, but the cost (Rs. 78) will have to be reduced before it is likely to be generally adopted.

74. *Sericulture.*—Operations during the past year have been mainly confined to the extension of mulberry planting. One *lakh* of seedlings raised in the Forest Department garden, Dehra, are now being placed out—35,000 with planters and the rest with cultivators. It is anticipated that an equally large annual distribution can be maintained in future years if cultivators will but take up the industry. Cottage cultivation in the Dún, however, will take some time to get over the sudden reduction in price by Messrs. Lister and Co., from Rs. 40 to Rs. 20, which was alluded to in last year's report.

During the continuance of the Government experiments the worms were made over to the cultivators ready hatched, whereas the seed is now given and the cultivators expected to rear the worm from the egg. The seed received in 1882 from Cashmere was distributed to some cultivators by the Superintendent of the Dún, but the produce was clearly inferior to that raised from Dún seed, as brought out in comparison at a judging committee held at Mussooree in May, 1883.

75. Messrs. Lister and Co. are reported to be making good progress in clearing and in planting up the required acreage of mulberry trees in the Song grant made over to them under a conditional lease by Government for purposes of sericulture. As noted elsewhere there were 28,000 mulberry cuttings distributed in 1882-83 from the Saháranpur gardens, while during the rains of 1883 a large number of three-year-old trees have been distributed from the Lucknow arboricultural nursery. Attempts were made many years ago to introduce sericulture into Oudh, and as a result there still exist in some parts of that province mulberry trees in fair number. The introduction of the univoltine worm, the culture from which occupies at the full some two months in March and April, and of the system of keeping seed at Mussooree until required, points to the possibility of sericulture being successfully carried on in the plains wherever mulberry trees in sufficient numbers conveniently adjacent to the rearing-sheds can be found. The seed raised in the Dún appears to be of as high a quality as can be desired. The seed depôt may be said to be ready. Mulberries are being planted out. All that remains is to obtain instruction for those ready to learn, a measure which is being kept in view. At the Saharanpur gardens during the past season most excellent cocoons were realised.

76. *Kumaun Orchard.*—This institution maintains the expectations formed of its usefulness as a centre for the distribution of apple, pear, and chestnut trees. It has been found possible for the current year to greatly reduce expenditure. The orchard now contains apple 5,137 trees, pear 637, chestnut 339 ; and the grafts ready for distribution amount to—apple grafts 14,934, and pear 447. During 1882-83, 1,892 apple grafts and 3,000 seedlings were given away.

77. *Tobacco Farm.*—The hopes expressed last year by Messrs. Begg, Dunlop and Co., the lessees of farms at Ghâzipur and Pusa, and referred to in para 68 of the last annual report, have to a fair extent been realised, as the cultivation of tobacco during the year under report is reported to have been more generally successful than it has ever been.

Five hundred and twenty-three acres against 482 in 1881-82 were under cultivation this year. Of this area 129 acres were confined to home cultivation, and 394 leased out to independent cultivators whose crops were purchased by the lessees. The total produce from both farms aggregated 362,000lb., or 36,000lb. over that of last year. The rate of produce per acre at Ghâzipur and Pusa was 570lb. and 793lb. respectively.

Exports of Indian-grown tobacco have shown a steady increase year by year, and rose during the year under report to 200,000lb. Of this quantity 7,000lb. were shipped for the first time to Holland and the remainder to England. In the Indian market sale was found for 30,000lb. ; 108,900lb. were manufactured into pipe tobacco and 23,100lb. into cigars and cigarettes.

78. *Saháranpur Botanical Gardens.*—The gardens remained under charge of Mr. Duthie for the period under report.

The main feature of their administration was a considerable increase in distribution of plants, amounting to 35,688 over the preceding year, of which three-fourths were mulberry cuttings. The increase likewise in distribution of seed, flower, and vegetable was very considerable. Scotch champion potatoes (disease proof) were tried with indifferent success. American cottons throve well and gave a high yield. Garo Hills cotton did not succeed. The same may be said of Ceara rubber and of *Withania coagulans*. On the other hand the salt bush (*Atriplex nummularia*) was a marked success, and promises to be of use on ground ordinarily worthless. Interesting observations on the growth of *sál* trees, which should be of value to the Forest Department, were carried out.

The first part of an illustrated manual of the field and garden crops of these provinces, compiled by Mr. Duthie and Mr. Fuller, C.S., conjointly, was issued from the press.

79. The hill gardens at Chajuri and Mussooree were abandoned in favour of a more suitable site at Arnigadh, about two miles below Mussooree, which latter site is now being commenced upon. Mr. Duthie spent a portion of the hot season of 1883 on a botanical tour in the Himaláyas, the report on which has not yet been received.

80. *Lucknow Horticultural Gardens.*—The expenditure on these gardens was as usual, with the exception of the Superintendent's salary, nearly covered by the receipts, Rs. 10,184, and omitting Rs. 900, which represents the value of the gratis distribution list

This result is due in a great measure to the success met with by Mr. Ridley, the Superintendent, in raising acclimatised seeds both of vegetables and flowers, the demand for which yearly increases. The *cherimoya* tree of Peru may be instanced as a valuable addition to our fruit trees ; other notable and successful introductions are the "Ice-rind" melon (American) and the "Soolyqua" gourd (Chinese). *Coffea arabica*, cinnamon, the camphor tree, and Paraguay tea, have all been successfully reared and flourish.

Eucalypti of several varieties continue in vigorous growth.

SECTION VI.—INTRODUCTION OF AGRICULTURAL IMPROVEMENTS.

81. Agricultural shows were held during the period under report at the following places:—Bahraich (May, 1882, and May, 1883), Khairabad, Meerut, Aligarh, Sahâranpur, Bulandshahr, Fyzabad, Gola Gokarn (Kheri), and Bijnor.

These shows are usually held in conjunction with some great gathering, such as the Syad Salar Mela (Bahraich) and the Gola Gokarn Mela (Kheri), and it may safely be assumed that three-fourths of the people present on such occasions earn their bread by agriculture. Beyond sending implements and samples of the farm grain for exhibition, and attending in person, if possible, the officers of the Department take little active share in the management on such occasions. Notes are taken, and the experience learnt at one show is communicated to the managing committees at other shows. Native gentlemen are now more generally to be found than formerly organising the arrangements, and with marked success. I am convinced that these institutions are worthy of every support, and are likely to increase in popularity with all classes so long as the calls for subscriptions are made with tact and moderation, and the expenses managed with the strictest economy. A spirit of emulation and interest in the comparative merits of grain samples was shown on one or two occasions in a manner which was most satisfactory. These gatherings will no doubt prove in time the best channel for the introduction of agricultural improvements.

82. Of improvements introduced through court of wards' estates the following may be briefly noticed:—

A'wa.—Well-sinking actively continued by Mr. Wilson. On 25 of the new wells a return of 10 per cent. in enhanced rent has been agreed for. Measures have further been taken to promote private well-sinking by cultivators. Under Mr. Wilson's superintendence upwards of 130 acres of waste land have been thoroughly stocked with *kikar*.

The stock of improved sugarcane mills has been increased to 100. The capital thus expended has been found to return 15 per cent.

Arboriculture has been largely promoted.

Two students have been sent by the estate to the Veterinary College, Lahore.

Dubari.—Three wells sunk successfully in sand in addition to 12 previously constructed.

Karam Ali's estate.—There is little to note here, save that estate capital invested in sugar mills to be let on hire to cultivators brought in a return of 31 per cent.

Raiatpur.—The report this year was chiefly remarkable for the success met with in new staples. American cotton realised Rs. 25 a maund when the best indigenous cotton was selling at Rs. 16 or Rs. 17. Sorghum and Cape oats proved successes.

83. *Distribution of selected seed.*—The following kinds and amounts of seeds were distributed during the season under report:—

Name of seed.	Quantity.		
	Maunds.	Seers.	Chittacks.
Wheat	280	26	0
Barley	0	30	0
Maize	5	6	8
Oats	13	25	0
Dhan	0	8	0
Japan pea	0	18	0
Linseed	0	30	0
Hemp	3	0	0
Cotton	28	3	0
American corn	0	1	0
Mangel-wurzel	0	3	8
Potato	11	0	0
Sorgho	11	37	0
Grasses	2	31	11
Tobacco	0	5	8
Ground nut	1	30	0

Of the 54 maunds wheat seed forwarded to Messrs. Inglis, Brown and Co., Sydney, a report was received in August, 1882, that the seed had been distributed in a satisfactory manner through all parts of the country. *Nim* leaves for use as a protection to seed against weevils was asked for, and a consignment sent, as well as *nim* seed for planting.

84. *Cattle-breeding.*—Fifteen *Kenwaria* bulls and seven *Hissar* bulls were purchased for district officers. Arrangements have been made through Pandit Adjudhia Parshad for the purchase of several young bulls in the Tarái.

A general ground of complaint against the bulls from Hissár has been their unsuitability to the district to which they have been consigned. Now, however, that the railway has reached Hissár, it will be possible for district officers to send good judges to make a selection, and it will be possible to work to better purpose than has hitherto been done the somewhat forgotten rules published under G. G. O. No. 91 (Military Department), dated Fort William, 6th January, 1877.

85. *Cattle-disease.*—In June, 1882, letters were received from the Deputy Commissioner, Gonda, and subsequently one from Pandit Adjudhia Parshad, reporting outbreaks of virulent cattle-disease and asking for aid. Two salutris were engaged, who had been trained under Veterinary Surgeon Anderson at the Lucknow Veterinary School, and were sent to the districts in question.

In Gonda 546 cattle were treated successfully and 47 died. In Sháhjahánpur (Pawáyan) 347 were treated successfully and 29 died.

Great difficulties were found, however, as usual, in dealing with the superstitious fears of the people, added to fears that a cure might have to be paid for. As the pay of a salutri and all contingencies for medicines may be roughly estimated at Rs. 350 per annum, a man has but to cure some 20 bad cases in the year to cover his pay in the average value of the cattle saved to the agricultural community.

SECTION VII.—TRAFFIC REGISTRATION.

TRADE.

86. Traffic was registered during 1882-83 in the same manner as during previous years. The arrangements embraced the record of three distinct species of trade :—

(1) Foreign trade.

(2) Internal road trade.

(3) Railway-borne trade.

87. The first related to the small amount of trade which crosses our northern frontier and passes into and from Thibet. It is maintained under the orders of the Government of India, and only half the total cost is debited to the Local Government. The second was originally started to provide a basis for estimating the utility or otherwise of certain roads in these provinces, and the position of the registration posts has each year been changed until now almost all the more important thoroughfares of traffic have had their statistics recorded. The third is one of the most important of the operations of this Department, and the statistics collected exhibit the nature and extent of the trade in the principal staples of commerce along the main lines of communication. The cost of collection is borne by the Imperial Government except in the case of the Cawnpore-Farukhabad and Muttra-Háthras Railways.

88. The following table shows the total cost of traffic registration during the past year :—

	Borne by Government of India.	Borne by Local Government, P W. D	Borne by this Department.	Total.
	Rs. a p.	Rs. a p	Rs. a p	Rs. a p.
Registration of foreign traffic along the Thibet and Nipál frontiers	2,292 0 0	...	2,507 14 0	4 799 14 0
Ditto of internal road traffic for Public Works Department purposes	...	4,000 0 0	11,387 3 9	*15,387 3 9
Railway traffic registration	8,040 0 0	...	600 0 0	8,640 0 0
" Total	10,332 0 0	4,000 0 0	14,495 1 9	28,827 1 9
Add —				
Cost of compiling staff	...	...	...	4,821 0 0
Ditto inspecting staff	...	...	...	1,200 0 0
GRAND TOTAL ...	...	...	...	34,848 1 9

* This includes the cost of river traffic and Rs. 20 per month for a broker

Taking up the three heads separately, a few explanatory remarks may be made :—

89. *Foreign trade registration.*—There were 28 posts along the frontier, of which 5 intercept the traffic from Thibet. All the remainder, except Julaghât, were visited by traffic inspectors during the year under report The one abovementioned, and the five on the Thibet frontier, are too remote to be readily accessible except by the district authorities. The details of the trade were given in the annual report submitted to Government with this office No. 834, dated 3rd August, but one or two salient features in the traffic will bear recapitulation. The total value of the trade was short of 90 lakhs of rupees, the insignificance of which will be appreciated when we see that it does not amount to one-tenth of the value of that transacted by Cawnpore alone, and is barely one-fifth of the value of the imports and exports of Agra.

The Nipál trade, as might naturally have been expected, forms by far the principal part of the total traffic, the trade with Thibet being but 7 per cent. of the whole. The value of the imports very largely exceeds that of the exports, and the result is a drain of silver from this country which can hardly be less than 15 lakhs on the transactions of last year. This consists mainly of taxes, octroi dues, *douceurs*, &c , payable to the Nipál and Thibet governments. Notwithstanding the precautions taken, it is clear from the nature of the case that only approximate accuracy can be looked for in the foreign trade returns. All the posts are distant from the head-quarters of the districts they are in and very distant from the head-quarters of this Department. The Thibet frontier posts are practically inaccessible, as they cannot be visited without an expenditure of time and money which the value of the returns would hardly repay. Nor does there seem to be any immediate prospect of improvement in this respect, and any conclusions therefore based upon these foreign trade statistics must be accepted with a certain amount of caution and reserve.

90. *Internal road traffic registration* —During the year under report the traffic on all the more important roads in the Agra Division and the province of Oudh (excluding Bahraich, Kheri, Hardoi, and Sultanpur was registered. This was the third year during which road posts were maintained, and all the principal thoroughfares of trade in the North-West (except those in Aligarh and the districts enumerated above) have now yielded statistics as to the traffic they carry. During the year 55 posts were maintained. The registration clerks were men who had nearly all of them been long accustomed to registration work, and the posts were each visited twice in the course of the year by Native Inspectors attached to this Department. Details as to the results of the registration have been given in a separate report.

91. *Railway trade registration.*—Quarterly returns were published during the year on the same lines as those of the preceding twelve months, and a detailed

report of the operations of the whole year was submitted to Government with my No. $\frac{8}{1030}$, dated 5th November, 1883. The returns were calculated as in former years from the invoices of the different railway companies, and a percentage was allowed for weight of packing materials. It is believed that the result represents very closely the actual weight of the commodities carried. No change was made in the number and boundaries of the existing internal blocks, which have now for two consecutive years been conterminous in the North-West with the divisions, the province of Oudh forming a block by itself. The total traffic for the past year exceeded in value that of the preceding twelve months by Rs. 1,96,96,513. This result is believed to be partly due to an increase in the railway traffic at the expense of that carried by road, but also in great part to an increase in prosperity amongst the community at large, owing to the general excellence of the harvests of the year. One of the most noticeable features of the traffic is the steadily increasing part which Bombay is beginning to play in carrying off the main exports of the provinces. This is of course due to the Rajputána line, which seems to be gradually absorbing traffic at the expense of the East Indian Railway.

MANUFACTURES.

92. (*a*) *Handicrafts.*—In accordance with instructions conveyed in G. Os. No. 424, dated 16th February, and No. 799, dated 5th August, 1881, arrangements were made for the first time in 1881 to collect information with reference to the more peculiar handicrafts of these provinces. The statistics so collected were published as a note supplementary to the Annual Railway-borne Trade Report. The same procedure was adopted during the year under report, and a comparison instituted between the figures obtained for 1882-83 and those of the preceding year. In addition to the handicrafts dealt with in 1881-82, similar information was collected with reference to the following:—

Khúrja pottery.
Agra wood-work.
Lucknow chintz.
Kálpi paper.
Lalitpur matchlocks.

The points enquired into were the same as those enumerated in last year's report, and need not be recapitulated.

(*b*) *Factories.*—Returns showing the working during the year of the following factories were received and compiled, and the results submitted to Government:—

List of factories.

Cawnpore	...	...	Cotton mills.
Ditto	...	...	Woollen mills.
Ditto	...	...	Cotton presses.
Ditto	...	...	Harness factory.
Lucknow	...	...	Paper mills.
Sháhjahánpur	...	...	Sugar factory.
Mirzapur	...	...	Lac factories.
Dehra Dún	...	...	Breweries.
Ditto	...	...	Tea factories.
Ditto	...	...	Silk factory.
Kumaun	...	...	Breweries.
Ditto	...	...	Tea factories.
Gházipur	...	...	Tobacco factory.
Through the provinces		...	Indigo factories.

All the information obtained was furnished by the courtesy of the proprietors, and reached this Department direct, except in the case of indigo factories, returns for which were furnished through Collectors.

SECTION VIII.—MISCELLANEOUS.

93. *North Indian manufactures.*—A sum of Rs. 5,000 has been placed at the disposal of this Department for the encouragement of local manufactures. Mr. Laurie's Great Northern Hotel at Allahabad is still utilised as a convenient centre for introducing Indian art manufactures to strangers visiting this country, and a quantity of goods of

all kinds are exhibited there for sale. During the year the two following consignments were also sent to the hotel of the same firm at Agra :—

	Rs.	a.	p.
9th December, 1882, Moradabad wares	220	5	1
1st February, 1883, Nagina ware	115	0	0
Total ...	335	5	1

The Treasury account stood as follows at the close of the financial year :—

Balance due at commencement of the year.	Drawings during the year.	Payments during the year	Balance due at end of year.
Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a p.
3,442 7 2	1,501 5 8	1,916 10 0	3,027 2 10

The goods to the credit of the fund are detailed below :—

	Rs	a	p.
Value of stock with Laurie and Staten	2,479	6	10
Value of stock at Cawnpore office	1,378	13	7
Advance recoverable	66	11	5
Debts from others than Laurie and Staten	140	4	0
Value of shop furniture, say	50	0	0
Total	4,124	3	10

It should be explained that of the sum of Rs. 1,378-13-7, shown as value of stock at the Cawnpore office, Rs. 995-13-3 will be recovered during 1883-84 for stock supplied on special indents immediately after the close of the year under report.

The excess of assets above the amount due to the Treasury represents profit. The sales Mr. Laurie effected during the year are entered below :—

Items	Supply accounts.		Sale account.	Balance in hand on 1st April, 1883.
	Unsold stock from previous year.	Supplied during the year		
	Rs. a. p	Rs. a. p	Rs a. p.	Rs a. p.
Ludhiána cloth	178 0 3	...	10 4 0	167 12 3
Azamgarh satinette	229 0 2	...	45 12 8	183 3 6
Nagina ebony	224 15 4	616 3 6	183 2 6	658 0 4
Mainpuri tarkashi	62 0 10	70 15 10	44 11 6	68 5 2
Moradabad ware	373 15 5	...	71 5 4	302 10 1
Benares brassware	63 15 9	...	..	63 15 9
Lucknow silver inlaid ware	373 4 7	...	157 0 9	216 3 10
Muttra silver ware	7 10 0	...	...	7 10 0
Multán pottery	22 6 3	106 9 0	51 15 9	76 15 5
Awamgarh pottery	..	17 12 9	16 10 9	1 2 0
Bánda pebbles	32 4 3	...	...	32 4 3
Agra inlaid ware	400 15 3	196 1 5	88 3 0	508 13 8
Jaunpur papier maché	207 12 0	...	81 4 6	126 7 6
Dacca silver work	45 15 0	...	...	45 15 0
Total ...	2,222 3 1	1,007 10 6	750 6 9	2,479 6 10

During 1881-82 the total sales amounted to Rs. 1,083-2-6 : consequently there was a falling off during the year under report. But besides the sales made by Mr. Laurie, goods were in some instances supplied by the Department direct. These realised the sum of Rs. 543-15-7.

94. *Steam plough.*—This was transferred from Bánda to Cawnpore, where it now awaits the orders of Government.

95. *Exhibitions.*—Exhibits of improved agricultural implements and of farm produce were contributed to the Joypur Exhibition.

Large collections of the raw products of these provinces were contributed to the Amsterdam Exhibition through the exertions of Mr. Duthie, Superintendent of the

Botanical Gardens, to whom two medals were awarded, and of Babu Lachhman Parshad, Superintendent, Cawnpore Farm, to whom was awarded a gold medal.

The art collections from these provinces for the Calcutta International Exhibition have been collected by district committees in correspondence with the Assistant Director for Oudh, while considerable aid has again been given in the collection of economic products by Mr. Duthie and by Babu Lachhman Parshad; agricultural implements and models are also being contributed by the Department.

96. *Kachi emigrants to Nagpur.*—These men, who were mentioned in the last report, have after some trouble settled down quietly in their new abode.

97. *Ghí-makers.*—In the last report it was mentioned that one of the two men sent to Australia had proved a failure and had soon been sent back. The other, by name Mákhan, has since returned with glowing accounts of the good pay and good treatment received. He was commissioned to engage and return with 20 other men, but the gentleman in whose charge he made the voyage to Bombay there engaged at once the full number required. Mákhan's employer (Mr. Palmer of Victoria) subsequently wrote to him to return alone, and placed funds at the disposal of the Department, but meantime Mákhan had accepted an offer from the Government of India to proceed with two others in charge of four buffaloes to Port Darwin, and proceeded in August on the long journey *viâ* China and Thursday Island.

98. *Correspondence with zamindárs.*—A very full and interesting report was received during the year from Pandit Ajudhia Parshad, which has been communicated to the public through the columns of the *Indian Agriculturist.* Other reports received were from the Bijnor Agricultural Society and from Kunwár Harnam Singh. It has lately been decided by the Local Government that Pandit Sri Lal, the Secretary of the Bijnor Society, shall, on proceeding to the Royal Agricultural College for the purposes of study, receive the same pecuniary aid as that afforded to Sayyid Muhammad Husain, now a student at the College.

A considerable number of letters asking for practical advice and communicating practical information were received and replied to. From Native States Pandit Het Ram, Diwán of Rewah, General Azim-ud-din Khan of Rámpur, and Chandi Parshad, Diwán of Chuttrpur, have been in frequent correspondence.

99. *General.*—Mr. Benett held charge for the whole period under report until the 17th August last, when he proceeded on leave. Mr. Fuller proceeded in July, 1882, to Nagpur, to officiate as Director of Agriculture for the Central Provinces. Major Pitcher joined the Department for Oudh on 18th June, 1882, and Mr. Darrah as Assistant Director for the North-Western Provinces on 22nd November, 1882.

An abstract of the total expenditure for the year is given in appendix II. Each head of revenue has been examined and tested in the manner laid down in Circular No. 34 (General), dated 5th October, 1882.

I may beg to be allowed to conclude with an acknowledgment of the great obligations of the Department to the services of Mr. Wilson, C.E., and of Mr. Darrah,—services which, as I am aware, Mr. Benett holds in the highest esteem.

I have the honor to be,

SIR,

Your most obedient servant,

D. G. PITCHER, MAJOR,

Offg. Director, Dept. of Agri. and Commerce,
N.-W. Provinces and Oudh.

APPENDIX I.

Note by MR. WILSON *on work done in connection with the deterioration of the soil by reh.*

THE work is classified under three heads :—

I.—Agricultural experiments.
II.—Survey of villages in the Akrabad pargana, Aligarh district.
III.—Preparation of maps.

I.—AGRICULTURAL EXPERIMENTS.

2. Experiments made in previous years under the heads of surface drainage, flushing, and manuring, having completely failed, the work during the past year has been confined to arboriculture, growth of special crops, and subsoil drainage.

3. *Arboriculture.*—The plots taken up for experimental plantations are as follows :—

(i)	In Áwagarh to the west of the fort ...	10·62	acres.
(ii)	Ditto near Koria-ka-Nagla	28·43	,,
(iii)	In Áwagarh, dug three feet deep	2·76	,,
(iv)	In Janaoli, north of the road	13·26	,,
(v)	Ditto, south of the road	35·44	,,
(vi)	In Jaithra	15·49	,,
	Total ...	106·00	,,

They are all in land belonging to the Áwa estate.

4. During the rains of 1882 a number of young kikar trees were planted out, the nursery having been started in the previous February. Kikar transplants certainly live in *úsar* longer than seedlings, but the experiments have proved that kikar will not grow in any but the best *úsar*.

It has been noted in previous reports that in every *úsar* plain there are patches of land covered with *dúb*, *dáb*, and other grasses which grow on good soil. In these patches kikar generally thrives, but in land covered with *khar úsara*, the distinguishing grass of *úsar* soil, it rarely lives. As far as this tree is concerned, the plantations looked more promising two years ago, when they were inspected by the heads of the Agricultural and Forest Departments of the Government of India, than they do now. Numbers of young kikar trees that then appeared to be doing well have since died. Some of them have died down during the hot weather and sprouted again with the commencement of the rains, only to die off in two or three months. The roots of some of these trees have been dug up and compared with roots of young healthy trees of the same size. Both the side roots and tap roots of the former are stunted and appear unable to make any progress in the saline soil.

In some parts of the plantations, however, which are covered with *khar úsara*, kikar is thriving, but this is due either to the thickness of saline soil being less than in other places, or to the quantity of saline matter not being sufficient to kill the young trees, though enough to support the *úsar* grass.

That the quantity of saline matter in *úsar* soil varies considerably can be readily seen by digging a few pits in an *úsar* plain. After a few days the sides of some of the pits will be found covered with a thick efflorescence, while in others the salt is only just apparent.

5. A nursery of chaunkar (*Prosopis spicigera*) was prepared during the rains of 1882. The young plants were dug up in February when they were 1½ to 2 feet in

height, but it was found that the roots were about five feet long; the soil being very hard, it was hardly possible to dig them out without injuring them. A few of the young trees were planted out, but they died. It was intended to start a second nursery at once and to dig up the young plants before their roots had attained a greater length than two feet; but the old seed that was in stock was found to be useless, and it was necessary to wait until fresh seed could be collected.

Some of the seed collected in May was sown at the commencement of the rains in 100 beds in the *Koria-ka-Nagla* plantation, about four inches of good soil having been previously put on the beds. The seed germinated freely and the plants look healthy.

6. Last year, when Mr. Buck was in Madras he ascertained that *Acacia leucophlœa (reunja, reru)* had been proved to grow better than any other tree in saline soil in that presidency.

This tree is common in the Jumna ravines, but is rarely seen in the *úsar* plains of these provinces.

At Mr. Buck's request one maund of seed was kindly sent to me by Mr. Wooldridge, of the Madras Forest Department. A nursery was formed, and about 2,000 young trees have been planted out with less than 15 per cent. of failures. The plants were less than 12 inches in height and the roots about 2 or 2½ feet long.

Kikar has strongly developed side roots, and even if its tap root gets down to the good soil, which is always found in an *úsar* plain by digging deep enough, the side roots remain in the saline stratum and the tree does not thrive.

The young *chaunkar* and *reunja* trees which have been examined have long tap roots with bunches of fibres at the ends, but no real side roots. There is therefore some prospect of these trees succeeding, notwithstanding the failure of kikar.

7. Six plants each of *Atriplex nummularia* (the Australian salt bush), *A. halinoides*, *A. sp.*, and *Chenopodium sp*, were received from the Govenment Botanical Gardens at Saháranpur in July, 1882. They were planted out in good land, as they did not look strong. In December, those which had survived were transplanted in *úsar* soil, pits being dug three feet deep and three feet wide, and refilled with the same soil mixed with some leaves. A marked improvement in the growth of the plants at once took place, and there appears to be no doubt that these plants, like the *úsar* grass, thrive only in a saline soil. They have been watered by *gharahs* sunk close to their roots and are now four feet high. They are in a plantation of the Aligarh Division, Ganges Canal, exactly opposite my bungalow, and are therefore more easily looked after than they would be if planted out in one of the experimental plantations.

In July of this year 150 plants of *Atriplex nummularia* and 30 plants of *Pentzia virgata* were sent from the Saháranpur Gardens, but unfortunately all of the latter and a number of the former were dead before they reached Awa. Those which survived were planted in the plantation near *Koria-ka-Nagla* and now look very healthy. During the present month Mr. Duthie has kindly sent 100 more plants of *A. nummularia* and 50 plants of *Chenopodium sp.* They were received in better condition than the former consignment, and have been planted out in the same plantation.

Of these plants *A. nummularia* promises to be the most valuable, as it has an abundant leaf growth and should yield a large supply of fodder. It remains to be seen whether it is of the same value to cattle in this country as it has proved to be to sheep in Australia.

The number of plants in this country are insufficient for a thorough experiment, and Mr. Duthie has written to Australia for a hundredweight of seed, and has kindly promised to let me have some of it as soon as it is received.

8. During the past year all the plantations except that at Jaithra have been irrigated from the canal once in from four to six weeks. At Jaithra the plants have been watered by *gharahs*.

9. During the rains of 1882 *úsar* grass was dibbled in the numerous bare patches which then existed. When the dibbling was done, during or shortly before rain the grass came on well, but when succeeded by dry weather it nearly all died. The plantations are now well covered with grass, though there are still some bare patches.

As an experiment some of the grass was cut towards the close of the rains of last year, the cut grass being left on the ground to rot. The result was that the young shoots of growing grass underlying the rotten grass died off. This would probably not have happened if the land had been unirrigated.

In a few spots the grass has become very thick and has dried up, killing off the grass under it in the same way. The dry grass has been removed and fresh grass has sprouted since the rains began.

The limit of the time which the grass should be left uncut appears therefore to have been reached, and this year arrangements have been made to cut it, make it into hay and stack it.

10. Experimental cuttings of grass on plots 20 feet square have given the following results :—

Situation.	Month in which the land was taken up.	*Weight of hay per acre.*			Remarks.
		In December, 1881.	In December, 1882.	In September, 1883.	
		M s.	M. s.	M. s.	
In Ákwagarh, west of fort ...	March, 1880,	28 22	59 30	76 20	Watered by *gharahs* up to December, 1881, and since then from canal.
Ditto, near Koria-ka-Nagla,	May, 1881,	15 38	59 30	82 15	Ditto ditto.
In Janauli, north of road ...	March, 1880,	39 34	54 18	78 10	Ditto ditto.
Ditto, south of road and west of distributary	Ditto ...	37 7	46 19	54 5	Ditto ditto.
Ditto, south of road and east of distributary.	Ditto ...	53 5	53 5	59 30	Watered from canal from commencement.

The cuttings made this year contained a good deal of dry grass of last year's growth, and this accounts partly for the considerable increase which is apparent.

11. The following details of the condition of each plot are given in accordance with the orders of the Government of India, conveyed in the Review of the Administration Report of this Department for last year :—

(i) Ákwagarh plantation to the west of the fort, area 10·62 acres. The land was taken up before the rains of 1880. The greater part was covered with short grass, but portions were either bare or covered with efflorescence The land is now well covered with grass. There are clumps of *kikar* and a few *shishams* in places where *dúb* grass is growing. A few *nims* also are doing well. In the greater part of the plantation which is covered with *khar úsara*, the *kikars* that have been planted out have either died off or are stunted in growth; 171 young *reunja* trees have been planted out within the last three months and look healthy.

(ii) Ákwagarh plantation near Koria-ka-Nagla, area 28·43 acres. Land was taken up before the rains of 1881. The greater part of it was thinly coated with grass, but there were large bare spaces in it, some of them covered with efflorescence. During the rains of 1882 grass was dibbled about two feet apart in these patches, and it has since spread over the greater part of them. A corner of an old field is included in the plantation and has been used as a nursery, the trees left in it being now from 10 to 15 feet high. In places where *dúb* and *dáb* grasses grow the *kikar* trees that have been planted out look healthy and are from four to eight feet in height. Where *úsar* grass grows *kikars* have generally died out or are very much stunted in growth; a number of them which had been kept alive through the hot weather of 1882 have recently died. In June last *chaunkar* seed was sown in 100 prepared beds, and the young trees look healthy. Some *reunjas* have since been planted out from a nursery

started in February ; 797 of these are alive and appear to be thriving. There are 27 plants of *Chenopodium sp.* and 93 of *Atriplex nummularia*, which have been planted during the recent rains and which look very healthy.

(iii.) Two plots in Áwagarh dug three feet deep, area 2·76 acres. These plots were dug to a depth of three feet before the rains of 1881, and 2,190 cubic feet of block kankar were removed from the soil. One of them was kept flooded with canal water for some months, and some hemp grown in an adjacent field was ploughed into part of it. The plots were sown in the following cold weather ; half of each with mangel-wurzel and half with a mixture of wheat, barley, and peas. As mentioned in last year's report, no crop was obtained in the plot that had been flooded with canal water, and after irrigation the surface was covered with saline efflorescence. A small patch of good land was included in the other plot, and in this the wheat grew luxuriantly, while it and the mangel-wurzel failed entirely in the rest. In August, 1882, the plots were perfectly bare with the exception of the patch of good soil, which was covered with *dúb* grass. *Úsar* grass was dibbled in half of each plot, and *dúb* in the other half. The former has spread and the grass is now very thick, while the latter has died off, except in a few spots *Kikar* trees were planted 20 feet apart, but they look no better than in the other plantations ; 95 *reunjas* were planted out last month. A nursery was started in the good soil, but it was found that, owing to the ground having been loosened to such a depth, the roots developed very rapidly and were injured when they were dug out.

(iv.) The Janauli plantation north of the Túndla road, area 13·26 acres. The land was taken up before the rains of 1880 and was then well covered with grass. Part of it was ploughed up during the rains of 1880, with the result that the grass was partially destroyed and slight efflorescence appeared. Since then the land has not been disturbed, and it is now well covered with grass. There are clumps of *kikars* from 8 to 12 feet high where the soil is good, and some trees in *úsar* look healthy and are four to five feet high. But, as in the other plantations where *khar úsara* is thriving, most of the trees have failed ; 153 *reunja* trees have been planted out during the recent rains and look healthy.

(v.) The Janauli plantation to the south of the road is divided into two parts by the Nuh distributary. Its area is 35·44 acres. When it was taken up there was very little grass on it, except in some patches of good soil. To the west of the distributary there was a great deal of efflorescence. There is now hardly a sign of the latter and the grass is very thick. There are some large clumps of good trees 12 to 20 feet in height, where the soil is good. *Khar úsara* has spread over most of the land, and there are some strong healthy-looking *kikars* from 5 to 8 feet in height in parts of the *úsar* soil. In these places, however, the *úsar* is evidently of a better type than usual, as other grasses occur here and there mixed with the *khar úsara*. In the worse *úsar* the *kikars* have generally died or are stunted : 649 *reunjas* have recently been planted out. Some *farásh* trees were planted out in 1880, but most of them have died, and the few that survive do not look healthy.

(vi.) The Jaithra plantation has an area of 15·49 acres. It is divided into two parts by a road ; the portion to the south having been taken up in 1880, and that to the north in 1881. This is the only plantation in which canal water is not used. Where the soil is good there are clumps of *kikars* from six to eight feet high. In the rest of the plantation the trees are stunted, but very few have died. The *úsar* however is of a good type and, if canal water were available, this plantation would probably have proved the most successful of the six.

12. *Subsoil drainage.*—The experiment on the plot prepared as described in last year's report was continued. The pipes, which had silted up during the rains, were dug out and relaid. The plot has since been flooded with canal water whenever it was available. The surface has also been dug up twice to a depth of about 12

inches and a portion of it has been limed. There are signs of the soil having been cleansed to some extent, but it is not yet fit for growing ordinary crops. The extreme hardness and impermeability of *úsar* soil are against the experiment, and it is moreover one which could not be conducted on a large scale, except at a prohibitive cost.

13. *Growth of special crops.*—This is one of the heads under which the experiments suggested by the Reh Committee were classified. The *úsar* grass and the Australian salt bush with the species allied to it are the only special crops which at present give any hope of success, and the results of experiments with them have been noted under arboriculture.

14. There appears to be very little prospect of reclaiming *úsar* at a reasonable cost so as to make it available for ordinary crops by any of the methods that have been suggested, such as surface drainage, subsoil drainage, flushing and manuring. Where canal water laden with silt is available at a sufficient level above the country, silt tanks may be formed, and experiments by the Irrigation Department have shown that good crops of wheat and barley can be grown on silt deposited in this way on *úsar*. But this method of reclamation can be adopted to a very limited extent, and probably the most important experiments that can be made have reference to the utilisation of the land for such grasses and plants as will grow in it and will yield a large amount of fodder.

II.—Survey of villages in the Akrabad pargana.

15. There are altogether 65 villages in the tract marked out by the Reh Committee, and 63 of these had been surveyed by the end of July. The two villages remaining are Gopi and Gobra, and work had been commenced on the former, but was stopped by the rain.

Ten of the villages have been surveyed three times. They will be resurveyed during the ensuing cold weather and the results tabulated. It appears that *reh* has increased in some villages and decreased in others, but the change is very gradual.

In some fields *reh* has increased one year and decreased the next. As far as these ten villages are concerned, however, the surveys of the four years should enable some conclusion to be arrived at.

16. The *jinswar* statements taken from the patwáris' papers have been prepared for three years, and those for the last year are in course of preparation.

17. From the 1st of October last year a muharrir has been employed measuring the depth from the surface of the ground to the level of subsoil water in a number of wells in the 65 villages. A large brick with a numbered disc has been inserted in the masonry of each well so as to mark the place from which the measurement is to be made, and in many cases it was necessary to build up a portion of the steining. The wells are distributed fairly uniformly over the whole area, and the muharrir has a list of wells which he is to measure on each day of the month. There are altogether 210 wells, so that on the average seven are measured daily. A leveller has been employed taking the levels of the tops of the wells, and about half of his work has been completed.

18. During the rains of 1882 a drainage map of the 65 villages was prepared, and this has been checked during the recent rains.

III.—Preparation of maps.

19. The district maps showing by colors the proportions of *úsar* in every village have been completed as far as the Ganges-Jumna Doab is concerned. The maps of Bareilly, Pilibhít, and Moradabad are also finished, the errors in the returns that were noted in last year's report having been corrected. Maps of Budaun and Sháhjahánpur not being available in the Government Press, tracings have been made from copies

obtained from the Collectors of those districts. The map of Azamgarh is now being prepared.

20. A map showing the depth from the surface of the ground to the level of subsoil water is being prepared from returns furnished to this Department by district officers and giving the depth to the water surface in each village. The maps of all the Doab districts and of Jhánsi, Jalaun, Bijnor, and Gonda, have been completed. In addition to furnishing data that will be of service in preparing projects for well construction, this map will be useful in showing how the distribution of *úsar* varies with the depth to subsoil water.

W. J. WILSON,

30th September, 1883. *Executive Engineer on special duty.*

APPENDIX II.

Memo. showing total expenditure and receipts of the Department of Agriculture and Commerce, North-Western Provinces and Oudh, during 1882-83.

Heads of charges	Budget expense.	Budget receipts.	Actual expense.	Actual receipts.	Net expense.	Saving on budget grant.
	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
Office establishment,	22,572 0 0	*Nil*	21,100 14 10	Nil	21,100 14 10	1,471 1 2
Office contingencies,	6,828 0 0	"	6,033 13 10	"	6,033 13 10	794 2 2
Office travelling allowance.	3,000 0 0	"	2,303 4 0	"	2,303 4 0	696 12 0
Oudh office establishment and contingencies.	1,200 0 0	"	753 12 5	"	753 12 5	446 3 7
Gházipur tobacco farm.	6,500 0 0	6,500 0 0	6,499 10 2	"	6,499 10 2	0 5 10
Reh and glass experiment contingencies.	22,624 0 0	*Nil*	5,024 9 5	"	5,024 9 5	17,599 6 7
Ditto establishment,	2,376 0 0	"	2,080 7 2	"	2,080 7 2	295 8 10
Traffic registration...	21,292 0 0	"	18,635 3 3	"	18,635 3 3	2,656 12 9
Cawnpore experimental farm contingencies.	11,340 0 0	4,000 0 0	11,106 15 9	1,897 14 2	9,209 1 7	233 0 3
Ditto establishment,	5,160 0 0	*Nil*	3,853 14 6	*Nil*	3,853 14 6	1,306 1 6
Cawnpore experimental farm workshops.	10,000 0 0	2,000 0 0	7,867 7 0	4,638 15 9	3,228 7 3	9,132 9 0
North Indian manufacture.	5,000 0 0	5,000 0 0	1,501 5 8	1,916 10 0	*Nil*	*Nil.*
Seed fund imprest ...	2,000 0 0	2,000 0 0	5,223 9 9	3,708 7 3	*Nil*	*Nil.*
Bull imprest ...	2,000 0 0	2,000 0 0	1,435 5 3	1,228 10 3	*Nil*	*Nil.*
Well fund ...	15,000 0 0	*Nil*	7,546 11 10	*Nil*	7,546 11 10	7,453 4 2
Lucknow farm contingencies.	2,924 0 0	"	814 11 8	73 7 6	741 4 2	2,182 11 10
Ditto establishment,	576 0 0	"	286 10 0	"	286 10 0	289 6 0
Total ...	1,40,392 0 0	21,500 0 0	1,02,068 6 6	13464 0 11	87,297 12 5	37,557 5 8

ORDERS OF GOVERNMENT.

No. 378 of 1884.

From

The SECRETARY to GOVERNMENT,
N.-W Provinces and Oudh,

To

The DIRECTOR of AGRICULTURE and COMMERCE,
N.-W. Provinces and Oudh.

Dated Allahabad, the 27th February, 1884.

Sir,

Revenue Department.

I am directed to acknowledge your letter No. 1258G., dated the 21st December last, with which you submitted the annual report on the administration of the Department of Agriculture and Commerce, North-Western Provinces and Oudh, for the year ending the 30th September, 1883.

2. The last report submitted dealt with the operations of the Department up to the 31st March, 1882, and the present report therefore embraces a period of 18 months. By Circular No. 52½ of 1882, the agricultural year ending 30th June was prescribed as the period for report, and the present report therefore deals with a period three months more than was directed. But in modification of the orders referred to, the revenue year may in future be adopted as the year for which the report should be submitted.

3. In drawing up his report, Major Pitcher has adopted the arrangement recommended by the Government of India in their orders on the last report. The more important matters dealt with have already had orders passed on them, and it is unnecessary now to do more than refer to the leading operations of the year.

4. *Organisation and maintenance of village records.*—During the year important steps have been taken for the improvement of the staff maintained for the organisation and maintenance of village records. In some districts in which its inefficiency was recognised the existing staff has been strengthened, and the rules for patwáris and kanúngos have been carefully and thoroughly revised. The records required to be maintained have in some respects been simplified, and adequate arrangements for testing them have been made. The employment of the kanúngo staff on miscellaneous work, the detrimental effect of which on their proper duties has on many occasions been noticed, has been forbidden, and it is satisfactory to observe from paragraph 18 of the report that the practice has almost if not entirely died out. The importance of the work now performed by the patwári staff has necessitated the adoption of measures for securing a higher standard of qualifications amongst the members of it; and it has been determined to establish schools at the head-quarters of each district, a certificate from one of which will, after a short time, be an indispensable condition for appointment to a patwáriship. The reports of inspections made by Mr. Darrah

and yourself show that in most districts the work of the patwári was during the year of review efficiently carried on. Where the opposite was the case the cause was usually laxity of supervision, and the Collectors of Moradabad and Bijnor should take steps for the more complete control of the patwári staff in these districts in the future. The management in Jhánsi has been more than usually lax, and there and in Bánda special attention must be given to keeping the field maps up to date.

5. *Measures of protection, including arboriculture.*—The subject of well-sinking in these Provinces has been thoroughly investigated by Captain Chibborn, and the information collected by him, supplemented by the results of the experiments at Awa and Khairagarh, should enable the Department to deal successfully with the practical problem of well-sinking throughout the Provinces. Experiments have also been conducted during the year in connection with the deterioration of the soil by *reh*, and the possibility of utilising steam power for irrigation from rivers. It is impossible as yet to hazard a conclusion as to the ultimate result of those experiments; but the success of the Australian salt bush in the usar plantations seems satisfactory, and the results of its extended cultivation will be looked forward to with interest. Arboricultural operations were carried on energetically during the year, and the attempts made to enlist the sympathy of the land-owners in their favor were in some districts attended with very considerable success.

6. *Agricultural experiments, including farms.*—Experiments were carried on as usual during the year at the Cawnpore farm, and also at a branch farm which has been established at Lucknow. Useful information was gained as to the value of various manures, and the results of all the experiments are carefully tabulated with a view to the preparation after a number of seasons of reliable agricultural tables. A small quantity of *khaki* cotton was grown, and more extended experiments with this cotton are now being made. Sericulture in the Dún appears to be progressing satisfactorily under Messrs. Lister and Co., and the extension of mulberry planting there is being vigorously prosecuted.

7. *Introduction of agricultural improvements.*—The ploughs supplied by the Department maintain their popularity, and nearly fifty chain-water lifts were disposed of. A hand thresher was imported, which promises to be a success, as does an evaporating pan for sugar boiling on an American principle. Agricultural shows, which are steadily gaining in popularity, were held during the year in a number of districts, and though your Department takes little share in the actual management of these, they afford, as you remark, an admirable channel for the introduction of agricultural improvements.

8. *Traffic registration.*—The statistics which are collected affect three distinct species of trade, and the expenditure under each head was as follows :—

				Rs
Foreign trade	...	...	...	4,800
Internal road traffic	...	...	...	15,387
Railway traffic	...	...	...	8,640

In addition to this, the cost of the compiling and inspecting staff amounted to Rs. 6,021. Separate reports have been submitted showing the result of the registration. Owing to the inaccessibility of some of the foreign trade registration posts, a close supervision over them cannot be maintained, and the accuracy of the returns is open to doubt.

9. *Manufactures.*—Within the last two years much has been done towards accumulating information regarding the various handicrafts peculiar to the Provinces; and interesting accounts of the more important ones will be found in the Provincial Administration Reports of 1881-82 and 1882-83.

10. *Miscellaneous.*—The shop at the Great Northern Hotel, Allahabad, for the sale of Indian Art Manufactures was maintained during the year, but has since been ordered to be closed. It has served its purpose of bringing Indian wares more prominently into public notice, and the further connection of the Department with it was unnecessary.

11. From Appendix II. of your report it appears that the total expenditure of the Department during the year was Rs. 1,02,068 and the actual receipts amounted to Rs. 13,464. The net expenditure is stated as Rs. 87,257; but it is not clear how this amount was arrived at, nor why no entry is made in the column showing net expense under the headings "Seed Fund Imprest" and "Bull Imprest."

12. Mr. Fuller's connection with the Department, in which he did excellent service, terminated in July, 1882. The present report contains a record of much useful work; and the Lieutenant-Governor and Chief Commissioner observes with satisfaction an acknowledgment of the assistance in conducting the administration of the Department rendered by Messrs. Wilson and Darrah. During your absence in England the Department was efficiently administered by Major Pitcher.

I have the honor to be,

SIR,

Your most obedient servant,

J. R. REID,

Secretary to Government,
N.-W. P. and Oudh.

REPORT ON THE OPERATIONS

OF THE

DEPARTMENT OF AGRICULTURE AND COMMERCE,

NORTH-WESTERN PROVINCES AND OUDH,

FOR THE YEAR ENDING 30TH SEPTEMBER, 1884.

ALLAHABAD:

NORTH-WESTERN PROVINCES AND OUDH GOVERNMENT PRESS.

1885.

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GOVERNMENT 1885 N.W.P.&OUDH

REPORT ON THE OPERATIONS

OF THE

DEPARTMENT OF AGRICULTURE AND COMMERCE, N.-W. PROVINCES AND OUDH,

For the Year ending 30th September, 1884.

No. $\frac{22\ G.}{II.}$ OF 1885.

FROM

DONALD SMEATON, ESQ., M.A., C.S.,

Offg. Director, Department of Agriculture and Commerce, N.-W. Provinces and Oudh,

To

THE CHIEF SECRETARY TO GOVERNMENT,

N.-W. PROVINCES AND OUDH.

Dated Cawnpore, the 9th January, 1885.

SIR,

I HAVE the honor to submit the report on the operations of the Department of Agriculture and Commerce for the year ending 30th September, 1884.

SECTION I.

MAINTENANCE OF VILLAGE RECORDS.

NORTH-WESTERN PROVINCES.

2. The returns received for the past year were drawn up in accordance with the headings as given in the revised rules for patwáris and kanúngos.

With the introduction from 1st July, 1883 of the revised rules, additional establishments became necessary, and with the sanction of the Board obtained in each case on its merits, the following additions were made during the year: —

Assistant registrars	136
Muharrirs for sadr kanúngos	25
Peons for ditto	24

The annual inspections of districts showed that district officers had begun to recognize the necessity of restricting the duties of kanúngos to those laid down in the rules.

The examination of registrar's offices by sadr kanúngos was found so unsystematic that it became necessary to frame and circulate some instructions for their guidance.

A further circular had to be issued, defining the work in field-testing by the sadr kanúngo to be that of examining the work already done by the supervisor kanúngos.

With the sanction of the Board, and consequent on the numerous complaints from districts of the difficulty experienced by patwáris in carrying on field work without the aid of field names, permission was given for the insertion in the khasra of the field name under the field number.

3. **Printing of forms.**—The system of supplying printed forms through this Department on district indents framed in accordance with rules laid down for their guidance and carefully checked has proved both a success and an economy.

4. **Pargana books.**—After circulation to selected district officers, and after amendments directed by the Board, the revised forms as approved by Government have been sent to press.

5. **Patwári schools.**—These institutions were sanctioned from 1st October, 1883, and a report called for by G. O. No. 1042, dated 5th May, 1883, to be submitted for the half year ending 31st March, 1884, was duly submitted.

The results so far were scarcely satisfactory; being an innovation, various difficulties arose and experience was required. The report for the period from March, 1884 to March 1885, will, it is hoped, judging from a few recent inspections, show far better results.

In those districts in which settlements are in progress no school has yet been started.

6. **Re-arrangement of patwáris' circles.**—In two tahsíls of Basti the circles have been re-arranged at an expenditure well within the sanctioned grant.

The Gorakhpur re-arrangements have been provisionally sanctioned.

For Jaunpur and Mirzapur a report is yet awaited. Ten new kanúngos were appointed for Jaunpur and seven for Mirzapur.

For Gházipur a report has been submitted to the Board. Ten new kanúngos have been appointed.

For Ballia a new halkabandi has been sanctioned.

For Benares the re-arrangement has been postponed the present.

Agricultural statistics are not yet available for the permanently-settled districts.

The re-arrangement of patwáris' circles for Lalitpur has been completed.

7. **Maps for Supervisor Kanúngos.**—A correspondence has been opened regarding the supply of copies of village maps to supervisor kanúngos under rules 117 and 118. The matter is still under reference.

8. **Accommodation of village records.**—Under rule 24 it is required that certain records hitherto kept in the tahsíls should be transferred to the Sadr. Complaints were made of the general insufficiency of room at headquarters for these additional records, and, as a result of the correspondence, it has been proposed to retain the khasras at the tahsíls. On this point reports from district officers have been called for.

9. **Occupancy rights.**—A reference was received from the Government of India as to whether occupancy rights were increasing or diminishing, and in reply it was pointed out that the early returns were not reliable, and that it would take some years of registration under the improved forms introduced with the now rules to determine the point satisfactorily.

The scarcity of 1877-78 led to great changes. So far as the old returns are reliable, it was found that occupancy rights had increased in most of the districts of the North-Western Provinces.

10. **Kanúngo staff.**—The usual examinations were held at each divisional headquarters with the following results :—

	Examined.	Passed in all subjects.	Passed in some subjects.	Failed.
Sadr kanúngos	4	2	2	...
Registrar kanúngos	18	8	8	2
Supervisor kanúngos	53	19	31	
Candidates	213	64	136	13
Patwári teachers	11	3	8	...
Assistant patwári teachers	5	2	3	...
Assistant registrar kanúngo	10	3	7	...
Assistant sadr kanúngos	2	1	1	...
Total	316	102	196	18

An analysis of the kanúngo staff gives the following results :—

	Total number of kanungos.	Total number passed.	Total number not passed.
Sadr kanúngos	34	32	2
Registrar kanúngos	180	161	19
Supervisor kanúngos	466	429	37
Total	680	622	58

11. **Settlements** *Lalitpur.*—Detailed inquiry on the subject of the resettlement of this district has been deferred to the touring season of 1884-85.

Jhánsi.—The Commissioner supports the opinion of the Deputy Commissioner that, with the exception of the Gursarai estate, the whole district should be resurveyed at an estimated cost of Rs. 80,000.

Jaunsár Báwar.—Settlement operations are in progress. A report of the principles adopted in re-assessing has been called for by Government.

12. **Houses for patwáris.**—Opinions have been asked for from Commissioners of Divisions on the question of providing houses for patwáris within their circles.

13. **Inspection of districts.**—The following districts were inspected either by the Director or the Assistant Director, and the results duly reported in detail to the Collectors and to the Board. A summary only is here given :—

Aligarh.—Two tahsíls inspected. Registrar's work found very inaccurate. Directions for checking the figures were left for the guidance of the sadr kanúngo. Discreditable delay in filing village papers. At tahsíl Háthras the register of proprietary mutations had not been opened. The supervisors had spent too much of their time at the tahsíl, and had not finished their testing tours until the crops were off in the ground.

Meerut.—The work here on the whole was very good. There were inaccuracies detected in the pargana registers necessitating retesting. There had been delay on the part of supervisors in filing papers for 1290 fasli, and they had spent too much time at the tahsíl. It was found that 42 per cent. of the patwáris were now resident their circles.

Sahárunpur.—Serious defects were found in the manner of conducting work in this district both as regards the patwári and kanúngo staff, for which the sadr kanúngo's inaptitude for his post appeared to be chiefly to blame, and he has since been dismissed. I must here mention, however, that the omission to pass orders in regard to the correction of the village maps and their maintenance abreast of the yearly charges has had a great deal to do with the defective character of the patwári and kanúngo work.

Muzaffarnagar.—The work of the patwáris was found excellent ; but the same could not be said for the registrars' work, in which, owing to neglect to keep up the totalling registers prescribed by rule, various inaccuracies were discovered.

Budaun.—As a whole the work of patwáris and kanúngos was very good ; the exceptions being the registers for Gunaur and Sahaswan, in which great inaccuracies were discovered.

Moradabad.—The arrears complained of last year had been made up, and in Hassanpur only were great inacuracies found. The supervisors had done remarkably well, and a most decided improvement had taken place generally, as against the previous year.

Farukhabad.—Patwáris' papers and maps, where tested, were found in good order ; though the supervisors had spent an undue proportion of the time which should have been spent on tour at the tahsíls. The registrar's work was good save in tahsíl Aligarh.

Mainpuri —Owing to want of proper supervision on the part of the sadr kanúngo, various irregularities were found in the registers and in the work of the supervisors. These latter spend too much time at tahsíls and too little on local work. Patwáris' papers were found fairly accurate, but changes in field boundaries are not up to date as they should be.

Sháhjahánpur.—The work in this district, which was bad in the previous year, showed little sign of improvement either on the part of registrars or supervisors, and a special report had to be made to the Board.

Muttra.—The work of the patwáris was found very good, and also generally that of the supervisors. In the registrar's work the absence of totalling registers, failure to open registers of proprietary mutations, and absence of settlement figures from the pargana registers were the desiderata.

Agra.—The work of patwáris, registrars and supervisors here was found on the whole very good, the absence of totalling registers and the new registers of proprietary mutations being the chief omissions.

Fatehpur.—Judging from two tahsíls inspected the work was very good, though supervisors were somewhat backward with their testing.

Cawnpore.—On the whole the work of both patwáris and kanúngos in this district was found unusually good and above the average.

Allahabad.—The tahsíl registers fairly free from errors. The supervisors unduly long at tahsíls and late with their field testings in consequence. A general failure on the part of the patwáris to correct their maps, for not attending to which the sadr kanúngo is to blame.

Azamgarh.—Registers of proprietary mutations not begun and settlement figures not yet filled into tahsíl registers. Arrears in tahsíl Nizamabad and good work in other tahsíls. The work of the supervisors thoroughly unsatisfactory. The kharíf jinswars for 2,000 villages were never tested at all.

Ghásipur.—Patwári and kanúngo rules only recently introduced and work scarcely yet in hand.

Jalaun.—The work of the patwáris, supervisors, and registrar kanúngos was found very accurate and up to time, save at tahsíl Jalaun, where there were arrears.

Jhánsi —Supervisors' work unsatisfactory, the testing work much too late, and registers inaccurate. The registrars were so behind-hand that they must have been idle for some months.

OUDH.

14. During the year under report the kanúngo' staff in Oudh was gradually brought up to the full number allowed under Circular No. 8-975R., dated 2nd April, 1883.

As far as possible none but passed men were appointed ; the exceptions being selected men of good family, who were, under sanction, appointed, subject to appearance at the next examination.

15. The new staff had not only to learn duties entirely new to them, but to train the patwáris to a new order of things. The class of men obtained are as a rule far superior in education and intelligence to the old hereditary kanúngos ; but these latter have in many districts bestirred themselves into activity and, after showing themselves at the first examination extremely ill-educated and ignorant, have passed with credit at the examinations succeeding. This year's experience shows that the efficiency of the kanúngos and improvement in punctuality and accuracy in patwáris' returns greatly depend on the amount of interest taken in their work by the tahsíldárs and also by the sadr kanúngos. However good the kanúngos themselves may be, there will be little improvement in the absence of active supervision and support from the tahsíldár.

16. Most of the district indents for forms under the old pattern had been sent in and were being carried out when the new forms were circulated. Nevertheless, at the cost of considerable trouble to themselves, district officers have submitted to this office the khasra appendices required from them in the new form, an exception being that of the milán khasras, which latter are still due from several districts.

17. Printed forms for the annual register of village statistics have been issued and the entries are under preparation. It has been ruled that 1291 fasli is to be the first year for which reliable statistics are obtainable. Statistics exist for previous years, but in their preparation there was very little supervision or check.

The sections relating to the preparation of the register of villages have undergone considerable modifications, and the printing of those registers will now be proceeded with. The delay in printing is of little practical importance, as detailed particulars mahálwar are being collected for each part on separate rough registers, from which latter they can at any time be transferred mauzawár to the printed registers of villages or parganawar to the annual register of village statistics.

18. Every district in Oudh was inspected during the year with the following results :—

Lucknow.—The sadr kanúngo, not having passed the examination, had been rightly held unfit to go on tour to inspect the work of passed men, and had been kept at the Sadr doing dakhil-khárij, takávi, and other work. He has since been transferred to another post and a passed kanúngo appointed in his place.

With the exception that the supervisor kanúngos had started on their testing tours very late, their work was found fairly good. It was found impracticable to examine the work of more than one of the registrars, and in that instance the work was not up to date.

The results of the patwáris' school were scarcely satisfactory, and the expenses seemed out of proportion to the tale of work. This has since been corrected.

The old forms were in use in this district for the year under report.

Bara Banki.—So far as the work of the supervisors went, it was fairly good ; but the men had been kept at the tahsíls much too long over annual returns, and had consequently been unable to start on tour until very late in the season. The work in two registrars' offices was examined. No preparation yet made towards the compilation of village registers, much miscalculation detected in the estimates for blank forms ; stock-books not kept in proper forms—all of which faults are now under correction.

The sadr kanúngo (an unpassed man), having shown himself unfitted for the post, has been transferred to another appointment and a passed man has been appointed to officiate.

The patwári school here is flourishing vigorously. The Deputy Commissioner is making great efforts to increase the attendance and is giving the subject much personal attention.

Unao.—The sadr kanúngo had done no inspection work and had not passed ; being, besides, a man wanting in the qualities necesary for the post, he has since been replaced by a passed and efficient kanúngo.

The hereditary kanúngos in this district have always been notoriously inefficient, and, with the exception of Pandit Shiu Nath, none of the tahsíldárs appear to have taken any trouble in seeing that the kanúngos—new and old—did their work. The supervisors as a rule were late and perfunctory with their work ; the new men in many instances, particularly in Purwa, following the example of laziness set by the old men. The only registrar's office examined was well conducted.

The patwári school here has been a complete failure ever since its establishment ; it is now being re-organised.

Fyzabad.—The blank forms had been issued late, and an attempt to bind in volumes previous to issue had still further delayed work. Issuing in bound volumes of a uniform size tends to great waste in paper.

Supervisors had commenced their tours very late and had been employed in work not sanctioned by the rules, such as laying out new roads and inquiries in dákhil-khárij cases. The patwári circles in some of the parganas are hopelessly involved, rendering supervision difficult. Still, with all excuses, the work of some of the supervisors was very poor. It was found that landlords in some cases kept the patwáris at work on private accounts, to the detriment of their work under the rules, and the attention of the Deputy Commissioner has been called to this. The registrar kanúngos were in arrears with work.

The sadr kanúngo (unpassed) was on tour, but the variations in form of roznámchas and registers kept by supervisors showed that his inspections had little effect.

The patwári school here has been a great success, every patwári in the district not specially exempted having passed.

Bahraich.—The sadr kanúngo (unpassed) had been on tour; but, considering the errors he had failed to discover, his work was practically of no use.

Registrar kanúngo's office in arrears with work. He had to keep up a number of registers unsanctioned by the rules.

The supervisors appeared to have had a great deal of work to do unsanctioned by the rules; and although they began their tours early, the amount of work done was in some cases unsatisfactory, particularly in two cases, in which the name of one supervisor was sent up for dismissal and of another for fine.

Patwári school.—All the patwáris in this district save 17 have either passed or been exempted. Attendance at the school has now fallen off owing to active competition by a school for patwáris established by the Kappurthala State.

Gonda.—The sadr kanúngo had been on tour, but had shown little work for it. The testing registers of supervisors had been drawn up in various ways and without check. The issue of blank forms to patwáris had been lavish and unsystematic.

Consequent on the absence of proper directions, the work of the supervisors generally was far from satisfactory. The men had also been employed on duties other than those sanctioned by the rules. One kanúngo was reported for suspension and another for reduction of pay.

In five forest villages no patwáris had yet been appointed.

The patwári school is well attended and most efficient. There is a considerable surplus in assets over expenses.

Sitapur.—The sadr kanúngo (unpassed) had not been on tour, nor had he apparently taken much trouble to organize into some system the procedure of the supervisors.

Supervisors appeared in some cases to have spent a great deal of their time in going backwards and forwards to the tahsíl. Testing registers had been kept in very diverse ways and the issue of blank forms had been wasteful.

The work of the patwári school was fair.

Hardoi.—The sadr kanúngo had been on tour and had been most energetic in enforcing the rules, the result of which was seen in the improved and systematic working of the supervisors.

The kanúngo staff generally were found in a very forward state of organization, and in the submission of periodical returns this district has taken a long lead of the rest in punctuality.

The sadr kanúngo has since been granted a special certificate under rule 95, the first that has been issued.

Kheri.—The sadr kanúngo (a recent appointment) had been on tour with good results.

Supervisors had been on tour, but in many cases the amount of testing was insufficient.

Complaints were made of the pay of patwáris being kept back by landlords, and in 15 waste-land grants now under cultivation no arrangements had apparently been made for the appointment of patwáris.

Rae Bareli.—The sadr kanúngo had not been on tour owing to press of takávi work and annual returns.

The new forms had come into use, but had been distributed without due reference to actual requirements and in excess. Registrar kanúngos appear to maintain a number of registers which form no part of their work under the rules. At the same time their own proper work was in arrears. Supervisors went on tour at the proper time and did fair work. This was due to efficient supervision by the tahsíldárs, particularly those of Mahárájganj and Dalmau.

It was found that the large fee-simple estate of "Palmerland" furnished no returns. Correspondence on the subject with the Commissioner is now going on.

Sultanpur.—The sadr kanúngo (unpassed) had been on tour; but his inspection work was found most unsatisfactory, and his transfer was recommended.

The kharíf jinswárs had not been filed for the district on the 19th April. The work of the registrar kanúngos was in arrears. Blank forms were issued very late.

Supervisors had begun their tours late and had maintained them irregularly, spending too much time at the tahsíls. One was reported for reduction of pay until qualified in a knowledge of the new rules.

Partabgarh.—The sadr kanúngo had been on tour and his inspection of both field and office work had been effective; but a special certificate was withheld, as, at the end of the year, it was found that the submission of returns had been most unpunctual.

The work of the registrars appeared good. The supervisors had begun touring late and, notably in Kunda, work had been assigned to them not sanctioned by the rules which interfered with the testing.

19. Generally speaking, the work of the patwáris in Oudh was found to be fair, and in some parganas extremely good. In several districts new copies of field maps have to be supplied to the patwaris where the landlords have taken from the patwáris the copy with which the latter worked prior to the new arrangements. In certain parganas of Bara Banki, Sultanpur, Fyzabad, and Gonda, the circles are so complicated and intermingled that the work of supervision becomes extremely difficult. Efforts are being made to simplify such circles, but progress must be slow.

20. Examinations were held by the Assistant Director for Oudh at the headquarters of each Division in July and August, 1884, with the following results:—

	Total number examined in 1884.	Passed in all subjects.	Passed in some subjects.	Failed.
Sadr kanúngos	9	3	5	1
Registrar kanúngos	32	15	16	1
Supervisor kanúngos	96	53	34	9
Candidates	86	42	39	5
Total ...	223	113	94	16

The total strength of the staff at present employed in each district is as follows:—

	Total number of kanúngos.	Total number passed	Total number not passed	Total number under 43 years of age.			Total number over 43 years of age.		
				Passed	Partially passed or failed.	Exempted.	Passed	Partially passed or failed	Exempted.
Sadar kanúngos ...	12	3	9	3	7	1	...	1	...
Registrar kanúngos,	43	17	26	16	15	...	1	11	...
Supervisor kanúngos,	186	139	47	132	29	...	7	16	2
Total ...	241	159	82	151	51	1	8	28	2

SECTION II.

Analysis of Districts.

21. It has not been found practicable yet to attempt this work; but as a step towards it, a form of pargana-book, has been approved by the Board and is now in Press.

These books will be kept at the tahsíls by registrar kanúngos in English figures and will be made up by November 1st for the agricultural year preceding. There will be six pages for each village. The first page contain the permanent statistics of the village, such as total area, population, Government demand.

The second and third pages will contain for each year the totals of culturable area, rent demand and collections, rent and ejectment cases, coercive transfers, areas of sír and of land held under occupancy rights, total area irrigated.

22. Officers on tour will call for the pargana-book on entering the pargana and carefully scrutinise the entries, officially investigating the causes leading to any great variations in the yearly totals and recording any fact worthy of permanent record affecting the economic condition of the people.

So soon as sufficient data have been collected to serve as the basis of a classification, one will be made of those mahâls which from defective irrigation or other causes are liable more or less to periodical loss of crop.

SECTION III.

[*Bank.*]

SECTION IV.

Measures of Protection, including Arboriculture.

23. As mentioned in Section II., measures have been taken during the year for ascertaining how far it might be desirable and practicable to secure protection for cattle in times of scarcity and benefit to agriculture generally by organizing, through Government agency, fuel and fodder reserves.

Pending the receipt of opinions from district officers, a joint memo. was drawn out by Mr. Wilson and Mr. Darrah on this subject, based on such information as was already available in the records of this office, on receipt of which the Local Government placed a grant of Rs. 10,000 at the disposal of the Department for the formation of such reserves in the Aligarh district. Suitable plots have been marked out and surveyed, and proposals will shortly be submitted to Government

24. Owing to the release of the Awa estate from the Court of Wards in October last, the experiments conducted on the reclamation of usar for the last five years by

Mr. W. J. Wilson, Executive Engineer attached to this Department, have now been brought to a close.

These experiments were set on foot at the instance of Mr. Buck, and the final results are embodied in the memo. printed as an appendix to this report. They may be held to set definitely at rest many questions regarding the possibility of the reclamation of usar on an extensive scale, and as such to be of great value.

Large as the cost, spread over several years, may collectively appear, it is in the end more economical than frittering away smaller sums in a spasmodic way on unsustained efforts with subsoil drainage, deep ploughing, manures, and various crops. Any additional experiments that may be hereafter suggested can be conducted at a comparatively trifling expenditure at the Cawnpore Farm in the ordinary programme of the year.

25. Mr. Wilson's conclusions briefly are, that where canal silt is available it can be used for usar reclamation with every prospect of success; and that the only other remedies feasible are the enclosure of the land for reclamation by the uninterrupted spread of usar grass and possibly with salt-bush and arboriculture. Under arboriculture again, *kikar* in moderately bad usar and *reunja* and *chaunkar* in bad usar are the only trees which have given notable results.

26. Two plots of usar land were, with the sanction of Government, taken up towards the end of 1882 and enclosed. These plots are in charge of the Farm Superintendent, and the experience gained at Awa will there be utilized. Out of several salt-bushes put down last year one only survives, but that is noticeable as growing well and strong in the open on a bit of usar on which there is no sign of any other sort of vegetation. The rains of 1883 were unfavourable ; but this year the usar grass is making head, and there are a fair number of young kikar trees.

27. A note on the work in connection with the Moradabad State wells by Mr. Wilson is appended (II) to this report.

Arboriculture.

28. A grant of Rs. 67,435 was placed at the disposal of the Department under this head, the disbursement of which is shown in the following statement. The expenditure during the past year is shown below, with the total of the previous year in comparison :—

Division.	On groves.	On nurseries.	On avenues.	On lopping and felling.	Total, 1883-84.	Total, 1882-83.
	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
Meerut ...	150 14 0	619 10 9	10,646 3 3	104 6 9	11,521 2 9	8,977 12 9
Rohilkhand ...	62 0 0	726 2 4	5,456 2 7	73 0 0	6,317 4 11	6,853 1 8
Agra ...	87 11 9	1,344 14 5	7,285 9 0	56 1 11	8,774 5 1	10,209 11 6
Allahabad ...	412 7 0	1,481 15 5	7,956 3 1	355 5 5	10,205 14 11	9,389 0 3
Benares ...	486 12 3	895 4 6	4,031 10 0	64 14 0	5,478 8 9	5,383 0 1
Jhánsi ...	244 2 0	500 4 4	8,304 9 3	190 4 3	9,239 3 10	9,378 15 0
Kumaun ...	...	320 0 0	180 0 0	...	500 0 0	488 4 0
Lucknow ...	...	964 13 3	1,593 10 10	45 3 0	2,603 11 1	2,586 1 3
Fyzabad ...	15 13 0	219 9 1	1,167 6 8	6 0 0	1,408 12 9	1,880 11 7
Sitapur ...	36 0 0	305 8 9	1,819 15 8	87 0 9	2,248 9 2	2,034 10 9
Rae Bareli ...	...	229 14 6	1,304 3 10	42 0 0	1,576 2 4	1,818 5 9
Total ...	1,495 12 0	7,608 1 4	49,745 10 2	1,024 4 1	59,873 11 7	58,999 10 7

The receipts exceeded those of last year by over Rs. 7,000, as the following statement will show :—

Division.	From felling.			From lopping.			From fruit.			From other sources.			Total, 1883 84			Total, 1882-83.		
	Rs.	a	p	Rs	a.	p	Rs.	a.	p.	Rs.	a.	p	Rs.	a.	p.	Rs.	a.	p.
Meerut ...	9 823	7	11	2,234	13	6	949	11	0	...			13,008	0	5	11,440	13	6
Rohilkhand ...	971	2	9	227	11	9	216	7	3	365	10	0	1,780	15	9	8,877	1	1
Agra ...	5,360	9	1	713	2	2	610	5	6	279	5	0	6 963	5	9	3,839	2	0
Allahabad ...	3,575	15	6	1,165	10	11	884	7	3	345	0	6	5,971	2	2	3,962	0	8
Benares ...	1,350	10	0	199	13	10	2,468	8	0	293	8	4	4,312	8	2	4 686	7	1
Jhansi ...	380	4	3	808	1	7	55	9	0	261	8	0	1,505	6	10	404	11	5
Kumaun ...	...			...			...			...			...			...		
Lucknow ...	2 676	3	3	519	2	3	166	9	3	126	13	6	3,488	12	3	2,353	9	0
Fyzabad ...	71	14	9	36	5	6	303	9	0	22	13	6	434	10	9	157	5	6
Sitapur ...	15	1	0	415	5	6	...			31	0	0	461	6	6	188	6	9
Rae Bareli ...	100	3	0	117	11	6	119	0	0	22	2	3	359	0	9	777	5	3
Total ...	24,325	7	1	6,437	14	6	5,774	2	3	1,747	13	1	38,285	5	4	31,686	14	3

The increase would appear to be due to an unusually large sum realized by the sale of loppings and fellings in the Agra and Allahabad Divisions. Receipts from the sale of fruit, too, are much in advance of last year ; the Benares Division heading the list as usual with nearly half of the total income for the Provinces.

The net cost under this head was Rs. 21,587-6-3, against Rs. 27,312-12-4 in 1882-83.

29. The extent of road under operation and newly planted out is shown in the subjoined table :—

Division.	*Under operation.*		*Newly taken up.*		*Cost.*		
	1882-83.	1883-84.	1882-83.	1883-84.	1882-83.		1883 84.		
	Miles.	Miles.	Miles.	Miles.	Rs. a. p.		Rs. a. p.		
Meerut	180	273	127¾	53	7,921	7 11	10,646	0 5
Rohilkhand	109¾	151	46¾	40	5,754	8 3	5,456	2 7
Agra	194¼	395	195¾	203	8 102	12 11	7,285	9 0
Allahabad	185	233	47¼	45	7,342	6 5	7,956	3 1
Benares	121	147	100¾	51	4,088	13 4	4,032	6 6
Jhánsi	181¼	206	23¼	14	8,205	4 0	8,304	9 3
[illegible]	19¼	20	10	1	178	4 0	118	0 0
Lucknow	23	38	18	53	1,563	9 10	1,593	10 10
Fyzabad	57	78	42¼	1	1,656	12 6	1,167	6 8
Sitapur	80¼	143	11¼	48	1,754	4 5	1,819	15 8
Rae Bareli	75	84	1¼	2	1,558	1 0	1,304	3 10
Total ...	1,226¼	1,768	624¼	511	48.126	4 7	64 9,84	3 1

1,768 miles of road, exclusive of the length newly taken up, were under operation against 1,226 last year.

30. The following statement shows the nurseries and their cost :—

Division.	Number of nurseries.	Number of trees at end of the year 1883-84.	Cost of maintenance.		
			Rs	a	p.
Meerut	11	22.987	619	10	9
Rohilkhand	17	27,734	726	2	4
Agra	36	54 943	1,314	14	5
Allahabad	36	39,274	1,481	15	5
Benares	24	27,448	999	8	0
Jhansi	9	13,843	500	4	4
Kumaun	7	5,199	320	0	0
Lucknow	7	49,327	898	7	6
Fyzabad	8	15,937	219	9	1
Sitapur	10	5,848	305	8	9
Rae Bareli	2	17,979	418	13	3
Total ...	167	280,519	7,834	13	10

31. The following statement gives the extent of grove area :—

Division.	Number of groves.	Area of grove in acres.	Number of plants.	Cost of planting and maintenance.
				Rs. a. p.
Meerut	3	35	...	150 14 0
Rohilkhand	4	4	7	61 0 0
Agra	7	8	85	87 11 9
Allahabad	5	4	583	412 7 0
Benares	4	41	2,872	486 12 3
Jhánsi	14	43	477	244 2 0
Kumaun	...	...	...	...
Lucknow	...	...	...	...
Fyzabad	3	5	27	15 13 0
Sitapur	3	...	32	36 0 0
Rae Bareli	...	...	...	...
Total ...	43	140	4,033	1,495 12 0

32. The number of trees planted out were far in excess of those of the year previous. It is noticeable, however, that the ordinary country mango is extensively planted, and that little or no attempts are made at introducing varieties. My own opinion is that if grafts of several varieties were used for avenue-planting, a considerable income, in excess of the present, would be realized from the sale of fruit and also from the sale of young grafted trees from nurseries. The attention of district officers will be invited to the subject and efforts made to extend in this connection the nurseries established by different municipalities.

33. In the matter of irrigation there is nothing special to notice save the fact of an apparatus invented by Mr. Twigg, the Collector of Hamírpur, for watering fenced plants without destroying the fence. Briefly described, it consists of a long tin tube sheathed with split bamboos. One of these is carried on each water-cart and one end having been thrust through the thorn fence, the water can be easily delivered from the earthen pot furnished with a nozzle fitting into a leather bag which is attached to the outer end of the tube.

SECTION V.

Agricultural Experiments, including Farms.

34. Experiments were conducted as in previous years at Cawnpore, and for the most part on the lines indicated in last year's report.

35. The kharíf season of 1883 was characterised by scanty and ill-distributed rain and in consequence by a general outturn less than in the preceding year. The deficiency in rain, however, served to bring into greater prominence the advantages of deep over shallow ploughing; one ploughing with the improved farm plough giving 18 per cent. increase over two ploughings with the ordinary native plough. Thus the small additional cost of an improved plough is quickly recovered in an increased yield.

In the cotton experiments following the observation that the cotton plants on the outside ridges of the fields were the finest, plots were formed with ridges 3 feet apart. A large increase was obtained by that method from New Orleans and Nankin seed over plots where the seed was sown broadcast or in drills. The largest yield was 188lb. clean cotton to the acre obtained from selected and acclimatized New Orleans seed.

The manufacture of sorghum sugar was carried out with no more difficulty than that experienced with ordinary sugarcane juice; about 1,600lb. were manufactured and sold well.

36. The rabi season for 1884 was marked by an entire absence of rain, the crops having been dependent, for germination even, on artificial irrigation. Yet the maximum outturn, amounting to 51 bushels, was the largest ever known on the farm, and the average was likewise in excess of previous figures.

In the manure experiments cowdung proved to be the cheapest in comparison to its value as a fertilizer. Green soiling experiments were conducted on an extensive scale and results of value recorded.

The experiments in deep ploughing were as successful as in the case of the kharif plots.

An experiment of some interest was that of planting wheat on ridges alternating with fallow spaces, a substitute for manure being looked for in constant cultivation of the fallow spaces. This system has lately been experimentally revived in England and gives some promise of success.

37. Laboratory experiments with usar soil showed that, to a certain extent, sulphate of lime (or gypsum) induced fertility, and larger plots are being treated *in situ*.

38. Ensilage received continued attention, and juar forage was preserved successfully for eight months in simple pits dug in the soil. Elaborate experiments were made as to the feeding value of ensilage and figures given to show the cost of ensilising, the net result being that 8,000lb of juar forage cost as ensilage Rs. 15-14-8 at a time when the same quantity of dry and inferior fodder was selling for Rs. 25.

39. Amongst implements the Duplex plough, devised at the farm by the Superintendent, gave excellent results, and the pattern of water-lifts in use was still further improved.

40. The farm was well represented at different agricultural fairs, and has sent out large quantities of improved seed wheat.

41. *Sahâranpur Gardens.*—The year was marked by a destructive hurricane which caused great damage to the garden; nevertheless, the income considerably exceeded that of the previous year. The indents for drugs for the Medical Department were in amount double those of the previous year, and the distribution of seeds and plants showed an increase.

Several additions of interest were made to the gardens, including the *Rhus vernicifera* (Japan varnish tree) and *Yucca draconis*.

Improvement by selection of hot-weather vegetables and the acclimatization of European vegetables gave good results, particularly in the case of the Scotch Champion potatoe.

Salt-bush (*Atriplex nummularia*) is now an established success and seeds freely. Acclimatized seeds of ornamental plants are finding increased favour.

42. Mr. Duthie's contributions to the Amsterdam and Calcutta Exhibitions were awarded three gold medals and one silver medal. Mr. Duthie was on tour in the Himâlayas for three months, and returned with a large collection of plants and seeds. During the year the 2nd volume of "Field and Garden Crops of the North-Western Provinces and Oudh" and a List of Grasses of North-West India were published.

The new hill garden at Arnigarh is making good progress.

The Superintendent was placed in visiting charge of the Lahore Horticultural Gardens during the year.

43. *Lucknow Horticultural Gardens.*—Though the year was a bad one as to season, the financial results were very successful, the net cost of the gardens to Government being only Rs. 2,345.

Interesting and instructive experiments were conducted in fruit culture, and with several varieties of cottons; 14 new varieties of acclimatized flower seeds were added to the Garden catalogue.

An interesting experiment with *dûb* grass showed that by scraping the surface, or "chiling," as practised by natives, an advantage of 10,320lb per acre per annum is obtained over the plan of allowing it to grow and then cutting with a sickle.

The arboricultural and exotic nurseries show good results and progress.

The Lucknow Horticultural Show was, as usual, managed by Mr. Ridley with great success.

44. *Sericulture.*—Messrs. Lister and Co. are pushing forward operations with energy and have already completed far more than they stipulated for. Two hundred acres of mulberry have already been planted, and so far back as March last 200 acres more of land were cleared for planting, while there was an abundance of seedlings, amply sufficient for planting out a thousand acres. Fifteen and-a-half ounces of seed used during the year produced 1,076lb. of green cocoon, or 67lb. to the ounce of seed, at a total cost of Rs. 110-9-5. From the cocoons reserved 20lb. of seed were produced, worth at Rs. 5 per ounce Rs. 1,600. The management have hitherto felt the want of a sufficient number of rearing-sheds, which are now being rapidly constructed. As in the previous year, prizes were offered for the best cocoons produced under cottage cultivation, but the result was scarcely satisfactory, and there appears little hope of cottage cultivation ever becoming popular so long as cultivators are expected to rear the worms in all stages from seed.

45. *American tobacco seed.*—In August and September, 1883, a quantity of freshly-imported tobacco seed was sent for experimental cultivation to seventeen districts of these provinces. The result cannot, however, be said to have been generally successful, as only three of the districts—Partabgarh, Gonda, and Unao—have reported favourably. The plants are here said to have flourished throughout, and in the end yielded a good crop. At Partabgarh the cultivators are reserving seed for future sowings.

SECTION VI.

Introduction of Agricultural Improvements.

46. *Fairs and shows* were held at Batesar, Nauchandi, Hardwar, Bulandshahr, Kakora, Aligarh, Partabgarh, and Bahraich.

Every opportunity was taken by the Department to exhibit the improved patterns of agricultural implements in use at the Experimental Farm, Cawnpore. Trained apprentices were deputed to exhibit the ploughs in working order at each fair, and after close of the fair to make a tour through some of the adjacent villages in view to affecting sales. The Duplex plough, invented at the Cawnpore farm, received a medal at the Bahraich fair. The Department was also awarded other prizes at Partabgarh and Bulandshahr.

47. *Court of Wards' estates.*—There is nothing of particular importance to report in connection with agricultural improvements in these estates. The Awa estate, which has for so long maintained a connection with the Department in this respect, was released on the death of the minor Rája in May last. It is in contemplation to take a more active part in forwarding well construction in all estates where funds are available. The Assistant Engineer attached to this Department will shortly be deputed to take this work in hand.

48. *Distribution of seed.*—The following statement shows the quantity and kinds of seed distributed by the Department during the year :—

	lbs.
Muzaffarnagar wheat	11,840
Mundhia wheat	680
Cape oats	3,360
Carrots and mangold	45
Sorghum	1,520
New Orleans cotton	540
Nankin cotton (1) Acclimatized	860
Nankin cotton (2) Fresh China seed received from the Government of India	2,000
American tobacco	12

49. *Cattle-breeding.*—Six Kenwariya bulls were procured for district officers from Bánda during the year.

SECTION VII.

Traffic Registration.

50. The following traffic continued to be registered throughout the year:—

(1) Traffic with the foreign countries of Thibet and Nepal transacted by road and river.

(2) Traffic with the seaports and the surrounding British Provinces and Native States transacted by rail.

51. The posts for the registration of the internal road traffic of the Provinces were maintained in the Agra Division and in 8 out of the 12 districts of Oudh till the 31st of August, by which time fully one year's statistics of traffic were collected. Mention of these was made in last year's report and the results of the registration of the traffic laid before Government in a separate report. Orders for registration of traffic in other quarters were obtained on 31st July, 1884, and the following posts were started in August:—

Place	*No. of posts.*	*Object of registration.*
Gogra river	3	To register the river traffic.
Rapti „	1	
Gumti „	1	
Ganges „	4	
Jumna „	3	
Aligarh district	7	To ascertain the utility of metalled roads.
Sahéranpur station	1	To classify and tabulate the traffic already registered by the octroi department.
Muzaffarnagar „	1	
Meerut „	1	
Bulandshahr „	1	
Aligarh „	1	

Trained and experienced muharrirs have been posted, and all the registration stations have been visited once by traffic inspectors maintained by the Department.

52. *Foreign trade.*—Registration of this traffic is maintained expressly by orders from Government of India, who bear a moiety of the expenses incurred in the maintenance of the registration posts. During the year 1883-84 the cost of registration amounted to Rs. 4,510-10-10, of which Rs. 2,152-1-11 were met from the Imperial revenues. No change was made in the cordon of posts, except that the post formerly located at Barmdeo was shifted to Tanakpur owing to a change in the course of the river Sarda.

The traffic with Thibet during 1883-84 exceeded that of 1882-83 in value by 2¼ lakhs of rupees, due to larger imports of borax and wool and of larger exports of grains. The traffic with Nepal was in excess of that transacted last year by 20 lakhs of rupees, due to larger imports of grains, oilseed, timber and gum in the districts of Pilibhit and Bahraich and of larger exports of cotton goods from these districts in return.

53. *Railway traffic.*—Registration of rail-borne trade was maintained on the block system. Quarterly returns were received and published for the information of traders and others in the local *Gazette*. Excepting Rs. 600 paid for registration of traffic carried along Provincial Railways, the cost of registration was borne by the Imperial Government. The number and boundaries of the blocks remained the same as in the last year. The weight returned was taken from the Railway invoices received in Railway offices for audit, while the value was calculated in this office from rates prevailing in the Cawnpore market. The total value of the traffic of the united provinces aggregated Rs. 28,67,66,809, against Rs. 26,88,12,957 in the preceding year; the

increase lying principally in the exports of wheat to the ports and in imports of cotton goods and metals received therefrom.

				Rs.
Total increase in the trade of the united provinces	...	...	...	1,79,53,852
Increase in wheat exported to the ports	...	...	...	68,93,778
Increase in cotton goods imported from the ports	...	...	...	52,94,590
Increase in metals imported from the ports	...	...	...	60,86,681

The value of exports amounted to Rs. 14,53,07,244, and of imports to Rs. 14,14,59,565, thus showing a balance in favour of these Provinces of Rs. 38,47,679.

SECTION VIII.

MISCELLANEOUS.

54. *North Indian manufactures.*—Orders having been received for the final closing of the depôt maintained at Mr. Lawrie's Hotel at Allahabad for the sale of these wares, arrangements have been made with Mr. Lawrie, who has agreed to purchase the unsold stock, and thus finally conclude the transaction.

55. *Steam plough.*—The engines belonging to this implement were transferred in February last to the Forest Department under the orders of Government, as no further use could be found for them at the Cawnpore Experimental Farm.

56. *Ghi-makers.*—By desire of the Government of India a batch of five ghi-makers in charge of six buffaloes were sent to Port Darwin in September, 1883. Both men and animals appear to have withstood the change and climate successfully. The men are pleased with the treatment they received from the Government of South Australia, and have returned after completing their period of contract in the eager expectation of being sent back once more. Makhan, the head-man, is reported to have received a medal at the Calcutta Exhibition for some of the buffalo ghi made by him in Australia.

57. *Sál bark as a tanning material.*—A specimen of the concentrated essence of sál bark was received from the Conservator of Forests, with an enquiry as to its value as a tanning agent. The Superintendent of the Harness Factory at Cawnpore, to whom the essence was sent for test, writes :—" The sál extract appears to be a very useful tanning and dyeing agent. Can any large quantity of this extract be supplied?" To this the Conservator has as yet sent no reply.

58. *Agricultural Societies.*—A report received from the Bijnor Agricultural Society during the year shows that it continues to take an interest in its work. This Society has since March, 1884, started an agricultural journal which will no doubt prove useful in time. A new Agricultural Society has also been started at Aligarh under favourable auspices. Both these institutions have been promised every possible support by this Department, and it now remains to be seen if they will accept of the offer and so materially help the Department in one of the main branches of its work, *viz.*, that of communicating freely with the native agriculturist.

59. *Correspondence with zamíndárs.*—Among others of our correspondents Pandit Ajudhia Parshad as usual sent in a most interesting report on the operations of his farms at Indalpur. This report was specially noticed in the columns of the *Indian Agriculturist* and published at the instance of Government in the Government *Gazette* of these Provinces.

60. *Calcutta International Exhibition.*—Under G. O. No. 432, dated the 20th February, 1883, Major Pitcher, the Assistant Director for Oudh, was deputed on special duty in connection with the arrangements for the united provinces for the collection of artware, agricultural produce, and implements at the Calcutta Exhibition of 1883-84.

A complete report on this subject has already been forwarded to Government under cover of my No. $\frac{T}{126\text{-}A}$, dated 3rd September, 1884. It is therefore unnecessary to say more here than that both Provinces, liberally supported as they were by most of the municipalities and by the Inspector-General of Jails, were well represented. Notable among the gentlemen who contributed valuable loan collections were His Highness the Nawáb of Rámpur and His Highness the Mahárája of Benares. Thirteen gold, 30 silver, and 44 bronze medals and 23 certificates were awarded to the collection. The value of the exhibits amounted to Rs. 1,46,006, and the sales to Rs. 25,936.

General.

61. Mr. W. C. Benett held charge of the Department up to the 26th July, 1884, when he was relieved by Major Pitcher, who officiated as Director till I took over charge on the 12th August.

62. Mr. H. Z. Darrah, the Assistant Director for the North-Western Provinces, was transferred in the course of the year to Assam ; Babu Lachhman Parshad Barmah being placed in charge of the current duties of Assistant Director, North-Western Provinces. Mr. W. J. Wilson left on the 13th May on furlough, and was relieved by Major A. Cunningham, R.E. Mr. C. A. Copeland, the Assistant Engineer for the Court of Wards, has also been placed under the orders of the Department An abstract of the total expenditure for the year appears as an appendix to this report. Each head of revenue has been examined and tested in the manner laid down in the Government Circular No. 34, dated 5th October, 1882. Exclusive of the correspondence conducted by the Oudh branch office at Lucknow, as many as 20,000 letters were received in and despatched from this office during the year.

I have the honor to be,

SIR,

Your most obedient servant,

DONALD SMEATON,

Offg. Director.

APPENDIX I.

Memo. on the Expenditure on the Reh Survey and Experiments up to 31st March, 1884, *by* MR. W. J. WILSON, *Executive Engineer, Agriculture Department.*

STATEMENT A. shows the expenditure incurred under each sub-head during each year. The following is an abstract for the whole period :—

	Rs.	a.	p.
Survey of villages in the Akrabad pargana	7,830	12	2
Preparation of maps	3,587	14	4
Experimental work	7,270	15	0
Subsoil water survey in the Akrabad pargana	897	13	5
Drainage survey in ditto	225	10	3
Survey of proposed fuel and fodder reserves	60	4	8
Purchase of instruments and tools	556	12	6
Contingencies	998	4	1
Total	21,428	6	5

From this should be deducted Rs. 132-4-0 realized from the sale of grass, making the net expenditure Rs. 21,296-2-5.*

The expenditure under each sub-head will be noticed in detail :—

2. *Survey of villages in the Akrabad pargana.*—The tract of country under survey is bounded on the north by the Sasni road, on the east by the Kali nadi, on the south by the boundary of the Akrabad and Sikandra Rao parganas, and on the west by the Etáwah branch of the Ganges Canal. It includes the whole of 57 villages and parts of 8 villages.

The work consists in measuring and plotting all the *reh*-infected land in each village. A few fields are wholly affected, but in most cases the *reh* appears in small patches, sometimes not more than 50 square feet in area.

Some affected spots are covered with slight efflorescence, but by far the greater number are marked either by the seed not germinating or by the crop withering when a few inches in height. The work is plotted to a scale of 40 feet = 1 inch.

3. The establishment employed during the first season consisted of a munsarim on Rs. 75 per month and two amíns on Rs. 20 per month; but in November, 1881, the munsarim was dismissed and three amíns were appointed in his place.

In October, 1883, a further increase was sanctioned and the establishment now consists of—

1	amin at	Rs.	25	per month.
4	"	"	20	"
1	"	"	15	"
2	"	"	12	"
1	"	"	10	"

Some muharrirs have also been employed checking the areas computed by the amíns and preparing statements.

The survey is stopped at the beginning of the rains and the amíns are then employed working out the crop statement from the patwáris' papers. During the rains of the last two years two amíns have been engaged preparing a drainage survey of the villages.

The work done during the first season was not satisfactory. The amíns, being new to the work, did not recognize the affected spots, and when the work was checked

* Since the close of the financial year a further sum of Rs. 111 has been realized from the sale of grass, and Rs. 135-13-3 has been recovered by the sale of the produce of the fields in Bijaigarh which were taken up for experiment.

numerous inaccuracies were discovered. These were corrected, and as the amins gained experience fewer mistakes were made.

4. It was directed that 10 out of the 65 villages should be surveyed annually and the rest quinquennially. The following villages were selected for the annual survey :—

Nanow.	Dhanauli Chanouli.
Nagla Tula Ram.	Sahouli.
Kiblas.	Silpura.
Jajharpur.	Guelmai.
Bahadurpur.	Bhimpur Haripur.

In the last four villages canal irrigation has been stopped.

Omiting the first season's work, these 10 villages have been surveyed four times.

The rest of the villages have all been surveyed once, but a few months' work still remains in marking accurately the boundary of the land which was cultivated at settlement. The area of many fields bordering waste-land has been slightly increased by encroaching on the waste-land, and it is important to distinguish the *reh*-affected spots and the newly-cultivated land from those in the old fields.

With the establishment now employed the second survey of the 55 villages which have been surveyed only once should be completed by the end of March, 1885.

5. The total expenditure on the survey has amounted to Rs. 7,830-12-2, but this does not include any of the pay of the draftsmen.

The expenditure on the survey was estimated by the Reh Committee at Rs. 2,000 for five years, or Rs. 10,000 altogether (G. O. No. 2015, dated 9th September, 1879).

6. *Preparation of maps.*—Returns were obtained from the district officers giving the total area of each village and the area of usar in it. The percentages were computed and the district maps have been coloured as follows :—

Villages in which the area of usar does not exceed 1 per cent., of the old area, blue cross lines.						
Ditto	ditto more than 1 p. c., but not exceeding 2 p. c. coloured blue.					
Ditto	ditto	2 „	ditto	4 „		green cross lines.
Ditto	ditto	4 „	ditto	7 „		coloured green.
Ditto	ditto	7 „	ditto	10 „		yellow cross lines.
Ditto	ditto	10 „	ditto	15 „		coloured yellow.
Ditto	ditto	15 „	ditto	20 „		burnt-sienna cross lines.
Ditto	ditto	20 „	ditto	25 „		colored burnt-sienna.
Ditto	ditto	25 „	ditto	30 „		red cross lines.
Ditto	ditto	30 „	ditto	40 „		coloured red.
Ditto	ditto	40 „	ditto	50 „		black cross lines.
Ditto	ditto	50 „	ditto	„		coloured black.

Most of the district maps are on a scale of 2 miles = 1 inch, some of them on a scale of 1 mile =1 inch.

A map of the province on a scale of 8 miles =1 inch has been prepared from the Indian atlas sheets. The district maps have been reduced to the same scale and transferred to the provincial map. The scale is too small to show all the details given in the larger district maps, and the six classes distinguished by coloured cross lines have been absorbed in the six classes of the same colour, so that six classes only are shown on the Provincial map.

All the districts in the Ganges-Jumna Doab and the Rohilkhand Division have been completed.

7. A spring-level map, showing the depth from the surface of the ground to the level of subsoil water has been prepared, in the same way as the provincial usar map. The district maps are coloured as follows:—

Spring level not more than 5 per cent. surface of ground,						blue cross lines.
Ditto	more than 5 per cent., and not more than 10 per cent.,					coloured blue.
Ditto	10	„	ditto	15	„	green cross lines.
Ditto	15	„	ditto	20	„	coloured green.
Ditto	20	„	ditto	30	„	yellow cross lines.
Ditto	30	„	ditto	40	„	coloured yellow.
Ditto	40	„	ditto	50	„	burnt-sienna lines.
Ditto	50	„	ditto	60	„	coloured burnt-sienna.
Ditto	60	„	ditto	70	„	red cross lines.
Ditto	70	„	ditto	80	„	coloured red.
Ditto	80	„	ditto	100	„	black or sienna line
Ditto	100	„	ditto	...	„	coloured black or sepia.

In the Provincial map, on a scale of 8 miles=1 inch, these 12 classes have been reduced to six, as in the provincial usar map.

The map of the North-Western Provinces has been completed.

8. The sum charged against the preparations of maps has amounted to Rs. 3,587-14-4. Some map work in connexion with the *reh* survey is included, as well as the preparation of the provincial reh map.

9. *Experimental work.*—The Reh Committee allowed a sum of Rs. 3,000 for three years, or Rs. 9,000 altogether, for agricultural experiments (G. O. No. 2015, dated 9th September, 1879). The expenditure up to March 31st, 1884, has amounted to Rs. 7,270-15-0, distributed as follows :—

	Rs.	a.	p.
Arboriculture	4,521	1	7
Agricultural experiments	2,385	12	7
Evaporation „	152	10	0
Manufacture of glass	211	6	10
Total ...	7,270	15	0

10. *Arboriculture.*—When the work was started it was arranged that the experimental plantations should be formed in land belonging to the Awa estate, and that their cost should be shared equally by that estate and by Government.

The total expenditure is as follows :—

	Rs.	a.	p.
Paid by Government	4,521	1	7
Ditto Awa estate	4,231	12	6
Total ...	8,752	14	1

Deducting the amount realized from the sale of grass, the following is the net expenditure :—

	Rs.	a.	p.
Paid by Government (Rs. 4,521-1-7 — Rs 132-4-0)	4,388	13	7
Ditto Awa estate	4,231	12	6
Total net expenditure...	8,620	10	1

A further sum of Rs. 78-8-7 is therefore due from the Awa estate.

11. The detail of the expenditure is given below :—

	Rs.	a.	p.
Plantation at Awagarh to west of Fort	943	9	6
Ditto Korla-ka-Nagla	2,171	6	3
Ditto Nagla Bhirgadu	89	4	0
Ditto Janauli	3,478	15	0
Ditto Jaithra	817	13	3
	7,501	0	0
Nursery	320	9	9
Pay of Máli	246	0	0
Collecting seed and sundries	355	9	3
Purchase and repairs of tools	202	11	3
Cutting and stacking grass	126	15	10
	1,251	14	1
	8,752	14	1

12. The areas of the plantations are as follows :—

		Acres.
Plantations at Awagarh to west of Fort	... ...	10·62
Ditto	Koria ka-Nagla	28·43
Ditto	Nagla Bhirgadu	2·76
Ditto	Janauli	48·70
Ditto	Jaithra	15·49
	Total	106·00

The cost of the plantations has averaged Rs. 70·76 per acre if the general charges for nursery, tools, &c., be omitted, and Rs. 82·57 per acré including these charges.

13. The condition of the plantations at the end of September, 1883 is given in a note printed with last administration report of this Department, and since then very little has been done beyond maintaining them.

Some of the reonja trees—especially those planted out at the beginning of the rains—look very promising, as do also some of the chaunkars grown from seed.

A nursery has been formed to supply both these trees for planting out during the next rains.

The plants of Atriplex and Chenopodium received from Saháranpur are also thriving. The Atriplex received in 1882 has flowered, but produced no seed. Mr. Gollan, the Officiating Superintendent of the Saháranpur Gardens, writes that the flowers are unisexual and that sometimes flowers of only one kind are produced on a plant.

A species of Chenopodium has produced seed which has been sown, and some young plants thus obtained have recently been planted out.

Some seeds of *Atriplex nummularia* and allied species have recently been received from Saháranpur and sown in the nursery.

Some seed of the ice plant (*Mesenlizanthimum crystallinum*) was received from Saháranpur early in the year. It was sown in the nursery and some plants have recently been put out in the Koria-ka-Nagla plantation. It is said to be used in some places for the manufacture of carbonate of soda owing to the large amount of this salt which its ashes contain.

14. *Agricultural experiments.*—The sub-committee appointed to frame proposals as to the form which agricultural experiments should take suggested that besides arboriculture they should include—

Surface drainage.
Sub-soil drainage.
Flushing
Manuring and growth of special crops.

Scraping the reh off the surface of the ground and digging the soil to a depth of three feet have been added. One plot dug to this depth was constantly flooded with canal water. The effect of silting some úsar land adjoining a new channel in the Aligarh Division of the Ganges Canal has been watched. Some fields in Bijagarh, a village in the Akrabad pargana, have also been cultivated.

15. The experiments made up to September, 1883, have been described in detail in reports submitted to Government. During the rains of 1883 the plot under sub-soil drainage was sown partly with rice and partly with hemp, but both crops failed entirely. In the rabi season, wheat and barley were sown, and though the seed did not germinate at all uniformly, a decided improvement was apparent in parts of the plot, and some of the plants of wheat matured. The soil still contains an excess of saline matter, and from a pecuniary point of view the experiment is a failure.

16. During the last rains six fields in Bijagarh were taken up for experiment with the permission of the Manager of the Áwa estate and Ráo Balwant Singh of Sahauli, to whom they belong. The fields had been uncultivated for some eight years nominally on account of reh. Except in a few patches where slight efflorescence was apparent, the fields were thickly covered with dúb grass. They were ploughed first with the country plough, but it proved quite unequal to the work, and two modified English ploughs were obtained from the Cawnpore Experimental Farm. With these the result was very different, as the roots of the grass were cut through and the grass was turned over into the furrows. The area of the six fields is 14 bíghas 11 biswas. In 11 bíghas 12 biswas hemp (*Crotolaria juncea*) was sown for the purpose of ploughing it in; but owing to the very scanty rainfall and to the seed being sown rather late, the preparation of the ground having taken a longer time than was anticipated, the hemp crop practically failed in all but two fields, and only reached about a foot in height. One bígha 11 biswas was manured with indigo refuse and 11 biswas with ordinary village manure. The fields were sown with wheat and bijra and average crops were obtained, except in a few spots in which reh was apparent. Out of the total area of 14 bíghas 11 biswas 1 bígha 10 biswas 4 biswánsis is affected by reh. The experiment is interesting as showing that most of the land in the Akrabad pargana which has been left uncultivated for many years, and which is covered with dúb grass, will, if properly prepared, produce good crops. The cost of the experiment up to the end of March was Rs. 191-5-6.*

17. The only experiments which show any prospect of success either in reclaiming or utilising úsar are those included under arboriculture, the growth of special crops and covering the land with canal silt. Kikar, shisham, ním, and salvadara have been tried in the plantations, but have failed in bad úsar, though kikar thrives well in the spots of better soil which occur in the úsar plains. Reonja and chaukar promise well in bad úsar, and the experiments with them must be carried on for another year or two. The salt bush and úsar grass may be included among the special crops which appear successful. It remains to be decided which is the more useful. Where canal water is available at a sufficient level above the country to permit silting operations to be carried on, it affords the only known means of reclaiming the land and making it suitable for the growth of ordinary crops at a reasonable cost.

18. *Evaporation experiment.*—As reported previously, an apparatus for measuring the rate of evaporation of sub-soil water through 4 feet of soil was made up, but it was found to leak. It was repaired and erected several times and was then given up.

19. *Manufacture of glass.*—The result of the glass experiment was to show that little, if any, improvement could be made unless the operations were conducted on a large scale in one of the most improved furnaces, under the supervision of a professional glass-maker. The surface scrapings of the reh soil are suitable for making material similar to common bottle glass; but, owing to the impurities it contains, it is useless to try to make colourless glass with it. For making good glass in England it is found cheaper to employ specially-selected materials free from iron and other noxious ingredients than to use more easily obtained and cheaper material and to attempt to purify them in the furnace. The chief faults of the *kanch* made by the natives are that it is very brittle and full of air-bubbles. The strength of the glass is increased by adding lime to it, and some samples sent to England for analysis proved to be almost entirely deficient in these ingredients. To get rid of the air-bubbles a strong heat is required, and this can only be obtained in a properly constructed furnace of firebricks.

20. *Sub-soil water survey.*—It was arranged by the Reh Committee that the Irrigation Department should make observations of the rise and fall of the sub-soil water in the 65 villages which are being surveyed in the Akrabad pargana. The work was

* To this must be added Rs. 29-11-9 expended during the current year, bringing the total cost up to Rs. 221-1-3 Rs. 135-13-3 has been realized by the sale of produce, so that the net cost of the experiment has been Rs. 85-4-0.

commenced, but was given up owing to the reduction of establishment in October, 1882. The work was then taken in hand in this Department. Two hundred and ten wells have been selected ; the steining of a number of them has been repaired, and numbered bricks have been built into them all to mark the place from which the measurement is to be made. A steel chain 30 feet long is employed for measuring. The work is done by a muharrir, who has certain wells to measure on each day of the month. He is instructed to visit each of the wells very early in the morning before water is drawn from it, and if, when he reaches a well, he finds that irrigation is going on, the measurement of that well for the month is omitted. The measurements for all the wells have been plotted up to the end of March. Owing to the light rainfal of last year, the variation in the level was less than usual.

21. A leveller has been employed running lines of level from one end to another, so that the reduced levels of the level marks on the wells are known. The lines of levels have been marked on the village maps, which are on a scale of 315 feet = 1 inch. A map of the whole tract on a scale of 4 miles = 1 inch has been prepared by reducing the village maps by the pentograph. Some difficulty was at first experienced in joining the villages together, as the errors in the boundaries are liable to accumulate. The reductions were made on common country paper and were cut out by running a penknife along the boundaries. They were then fastened by drawing pins to a large sheet of paper, and adjustments were made until the errors were distributed as nearly as possible over the whole tract.

22. *Drainage survey.*—This was also to have been done by the Irrigation Department but was taken up in this Department in 1882. Two amins were employed during the rains to mark the lines of flow of the drainage water on the maps of the 65 villages, and the same men were engaged in checking their work during the last rains.

23. *Survey of proposed fuel and fodder reserves.*—This survey comprises some land in the Aligarh district which it is proposed to reserve for grass and fuel,, and the project for which has been submitted.

24. *Purchase of instruments and tools*—These include a pentograph, six plane-tables, two measuring chains, a chemical balance, phaoras, picks, and sundry tools.

25. *Contingencies.*—These include the pay of khalásís and sundries.

STATEMENT A.—*Showing expenditure on reh survey and experiments up to 31st March, 1884.*

Details.	Expenditure for the year ending 31st March, 1880.		1881.		1882.		1883.		1884.	
	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p	Rs. a. p.
Survey of villages in the Akrabad pargana.										
Establishment	248 1 0		1,380 0 0		1,371 8 8		1,364 7 2		1,792 8 10	
Pay of mirdahas, purchase of stationery and sundries.	...		362 2 3		169 3 3		609 7 11		513 5 1	
Total ...		248 1 0		1,742 2 3		1,540 11 11		1,993 15 1		2,305 13 11
Preparation of maps.										
Establishment	78 6 3		360 0 0		612 0 0		696 0 0		857 4 9	
Drawing materials and sundries	156 1 0		329 7 7		238 1 0		145 11 9		114 14 0	
Total ...		234 7 3		689 7 7		850 1 0		841 11 9		972 2 9
Experimental work.										
Arboriculture	63 8 0		1,294 7 2		1,490 0 7		911 7 9		761 10 1	
Agricultural experiments	217 3 9		642 15 10		842 2 3		231 6 3		452 0 6	
Evaporation ditto	120 0 0		10 0 0		22 10 0		...		...	
Manufacture of glass	11 12 0		...		...		199 10 10		...	
Total ...		412 7 9		1,947 7 0		2,354 12 10		1,342 8 10		1,213 10 7
Subsoil water survey in the Akrabad pargana.										
Building metams on wells	...		...		...		110 7 3		401 15 10	
Measuring depth to water	...		...		...		55 0 6		144 0 0	
Levelling	...		...		...		...		186 5 10	
Total ...		...		...		...		165 7 9		732 5 8
Drainage survey in Akrabad pargana ...	...	...	...	...	...	...	...	116 13 6	...	108 12 9
Survey of proposed fuel and fodder reserves ...	...	...	...	...	...	...	...	...	...	60 4 8
Purchase of instruments and tools	...	191 10 7	...	275 14 6	...	...	...	73 5 0	...	15 15 0
Contingencies	...	72 0 4	...	344 5 0	...	254 6 3	...	170 9 3	...	156 15 3
Total for year .	..	1,158 10 4	...	4,999 4 4	...	5,000 0 0	...	4,704 7 2	...	5,566 0 7

STATEMENT B.—*Showing the expenditure on arboriculture in usar soil up to 31st March,* 1884.

Details.	Expenditure for the year ending 31st March,									
	1880.		1881.		1882.		1883.		1884.	
	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
Farming plantation at—										
Awagarh to west of fort	...		396 0 11		278 1 1		166 15 6		102 8 0	
Kori-ka-Nagla (Awagarh)	...		...		1,327 1 0		525 12 3		318 9 0	
Bhargada (Awagarh)	...		...		...		64 4 0		25 0 0	
Janauli	...		1,426 8 3		1,215 10 6		525 8 9		311 3 6	
Jaithra	...		88 9 0		499 9 6		127 5 9		102 5 0	
Total ...		...		1,911 2 2		3,320 6 1		1,409 14 3		859 9 6
Nursery	63 8 0		115 5 9		68 4 0		56 0 0		17 8 0	
Pay of máli	...		48 0 0		30 0 0		84 0 0		84 0 0	
Collecting seed and sundries	...		153 0 6		107 1 9		22 3 0		73 4 0	
Purchase and repairs of tools	...		84 7 9		89 14 3		10 5 3		18 0 0	
Cutting and stacking grass	...		...		...		...		126 15 10	
Total ...		63 8 0		400 14 0		295 4 0		179 8 3		319 11 10
Total expenditure during year ...	...	63 8 0	...	2,312 0 2	...	3,615 10 1	...	1,582 6 6	...	1,179 5 4
Amount drawn from the Awa estate on account of plantation.										
From Awagarh treasury	...		1,017 9 0		1,630 0 0		543 9 0		315 6 3	
From Jaithra treasury	...		...		495 9 6		127 5 9		102 5 0	
Total ...		...		1,017 9 0		2,125 9 6		670 14 9		417 11 3
Amount expended by Government ...	...	63 8 0	...	1,294 7 2	...	1,490 0 7	...	911 7 9	...	761 10 1
Total expenditure on account of plantation ...	...	63 8 0	...	2,312 0 2	...	3,615 10 1	...	1,582 6 6	...	1,179 5 4
Deduct amount realized from sale of grass ...	...	...	...	...	...	...	...	...	...	132 4 0
Total net expenditure	...	63 8 0	...	2,312 0 2	...	3,615 10 1	...	1,582 6 6	...	1,047 1 4

APPENDIX II.

Note on the Moradabad State Wells by MR. W. J. WILSON, *Executive Engineer, Department of Agriculture and Commerce.*

THE last report on these wells was made by the Director of Agriculture and Commerce in October, 1882, and the condition the Hasanpur wells were then in is shown in statement A. Besides the 23 wells in the Hasanpur pargana, which were constructed by Government officers, there were 17 wells in the Amroha pargana under the charge of Muhammad Muhsin Khán of Amroha, and the zamíndár of Keshopur Bhindi had received Rs. 1,000 for the construction of three wells. But no details were given of any but the Hasanpur wells. The first three wells in this list had been tested and proved successful, so they will not be alluded to further in this note.

2. In September, 1883, the sanction of Government was obtained to the purchase of iron pipes, &c., required for making trial borings. The tools were received in January, and trial borings were commenced in the following month. The cylinders and pipes were cleaned, and statement B gives the measurements of the well, made by Sukhdeo Mal, the Sub-Overseer in charge of the work. It was proposed to make a trial boring in each well, starting from the bottom of the wooden pipes; but when the latter had been cleaned, it was found that in all the wells but one (Ekhonda No. 1) the wooden pipes were so crooked that the small iron pipes could not be sunk inside them.

3. Borings were made in the wells in Sahadri, Padli, and Ekhonda No. 2, starting from the bottom of the cylinders, and the soils met with are given below :—

	Ft.	In.
In the Sahadri well—		
Kankar and loam	0	3
River sand	25	2
Kankar and sand	0	10
Fine sand	5	2
	31	5
In the Padli well—		
River sand	13	5
White clay and kankar	1	10
River sand	16	3
	31	6
In Ekhonda No. 2—		
River sand	54	0
Kankar	1	0
Sand	8	6
	63	6

4. The cylinder of the Sahadri well is reported to rest upon clay, but if so, it must be a very thin stratum. The wooden pipe in the Padli well has been sunk into the bed of clay 13′ 5″ below the cylinder. When cleaning out the pipe of the Manota well pieces of clay and kankar were brought up in the sand pump, confirming the statement that the pipe rests on clay. A little clay and kankar was also brought up from the pipe in Ekhonda No. 1, showing that the pipe rests on clay; but as no mention of it is made in previous reports, it is probably a very thin stratum. No sign of clay was found when cleaning out the pipes of the other wells.

5. The cylinders of the Chak Dhanauri and Sodhpur wells had been plugged with concrete, so nothing more could be done to them. The supply of the Chak Dhanauri well was tested with the following results :—

Water surface in well lowered	2 feet	discharge	99	cubic feet per hour.	
Ditto	ditto	4	ditto	149	ditto.
Ditto	ditto	6	ditto	189	ditto.
Ditto	ditto	8	ditto	236	ditto.

6. The supply obtainable from some of the wells in which permeable plugs of broken brick and kankar had been placed was also tested and the following results were obtained :—

Well No. 1 of Dehri Jat.

Water surface lowered 2 feet, discharge 137 cubic feet per hour.
Ditto ditto 4 ditto 280 ditto.

After working for three hours with a head of 4 feet on the well sand came into the cylinder through the broken brick and the trial was stopped.

Well No. 2 of Rajohan.

Water surface lowered 2 feet, discharge 95 cubic feet per hour.
Ditto ditto 4 ditto 186 ditto.

When the water surface was lowered 6 feet sand came into the cylinder and the experiment was stopped.

Well in Bahádurpur.

Water surface lowered 2 feet, discharge 46 cubic feet per hour.
Ditto 4 ditto 97 ditto

Three inches of sand came into the cylinder during the trial.

Well No. 1 of Bawankheri.

Water lowered 2 feet, discharge 68 cubic feet per hour.
Ditto 4 ditto 99 ditto.

Three inches of sand came into the cylinder during the trial.

Well No. 2 of Bawankheri.

Water lowered 2 feet, discharge 26 feet per hour.
Ditto 4 ditto 52 ditto.

No sand came into the cylinder.

7. The discharges were tested by dhenklis with iron pots, as many as four dhenklis being sometimes worked on one well. When the height of lift is small there is an advantage in using dhenklis instead of leather buckets worked by bullocks, as the latter are constantly getting torn and the trial is stopped until they can be repaired. The water was first lowered 2 feet and a leaden plumb bob was hung over the side of the well at this level. The dhenklis were then worked just fast enough to keep the water at this level, and the number of pots raised in each hour was counted. The capacity of the pots being known, the quantity of water raised per hour was calculated. Each trial lasted three hours, the time being kept by a water clock. The water was then lowered four feet, the plumb bob was fixed at that level, and the discharge tested as before. If no sand came into the well the water was lowered 6 feet and so on. Directly sand came into the well the trial was stopped.

8. In this way the discharge of a well is obtained under different heads. Only four dhenklis can be worked on a 6 foot well, and the maximum quantity of water that can be raised by them is about 250 cubic feet per hour, so the discharge was limited to this.

It may be noted that most of the experiments show that the discharge from a well varies directly as the head upon it. Thus, when the water is lowered 4 feet the discharge is double what it is when the water is lowered only 2 feet, and when the water is lowered 8 feet the discharge is again doubled. This result was anticipated from the fact that when water flows with a very low velocity, as it does in percolating through sand, the friction varies directly as the velocity.

9. In the Chak Dhanauri well the supply comes entirely through the pipe, the bottom of the cylinder having been plugged with concrete. In the other wells which were tested the supply comes partly through the pipe and partly through the permeable plug.

With a head of 4 feet the Dehri Jat and Rajohan (No. 2) wells gave a better supply than Chak Dhanauri well: 280 and 185 cubic feet respectively against 149 cubic feet.

The other three wells, however, gave only 97, 99, and 52 cubic feet respectively with a 4 feet head.

Their cylinders are probably on fine sand or loam, which gives very little water.

10. The tubes in the Padli and Manota wells having been proved to reach clay, concrete plugs were put into the cylinders between the tubes and the masonry, so that the supply comes from below the *mota*. They are spring wells similar to that first made at Hasanpur.

11. In the remaining 15 wells (Nos. 9 to 23) the tubes are either on sand or kankar or a very thin stratum of clay, and there were four ways in which they might be completed :—

(1) The tubes might be sunk deeper until *mota*, or a thick layer of kankar, were reached.

(2) The tubes might be left as they were and a plug of concrete might be put into the cylinders round the tubes, as had been done in the Chak Dhanauri and Sadhpur wells.

(3) The tubes might be plugged up or removed and the supply obtained entirely from the bottom of the cylinders.

(4) The tubes might be left as they were and a permeable plug put into the cylinders round the tubes, so that the supply would be obtained both from the tubes and from the bottom of the cylinders.

12. *Before trying the first plan* it would have been necessary to make trial borings, to ascertain the depth to the clay or kankar; and even had clay been found within a few feet of the bottom of any of the tubes, it would probably have been found inpracticable to sink the tubes, which were already crooked, down to it. On this account it was not considered advisable to incur the expense of making trial borings

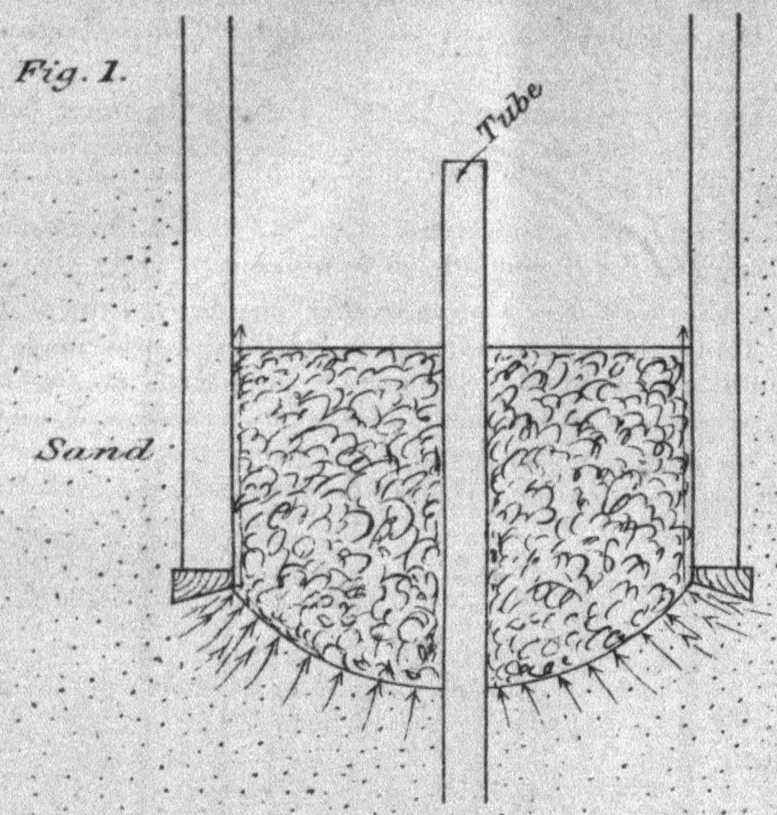
13. As to the second plan, the quantity of water obtainable from the tube depended entirely on the character of the stratum in which the tube terminates. If it is a thick layer of kankar the supply will be good. If it is sand the supply will be very small. The fact that the Chak Dhanauri well gives 236 cubic feet per hour with an 8 feet head is not conclusive, as we do not know but that an equal or even larger supply could have been obtained from it with a permeable plug under a 4 feet head, without sand coming into the cylinder.

The three wells in Bawankheri and Bahadurpur give every little water with a head of four feet, though they are supplied both from the tube and from the bottom of the cylinder; and it may be considered certain that if the better source of supply were cut off, the total supply obtainable from the well with the same head would be reduced.

14. The third plan need hardly be considered. We know that some of the tubes which have reached kankar will yield a fair supply, and it would be absurd not to take advantage of them now that they have been sunk.

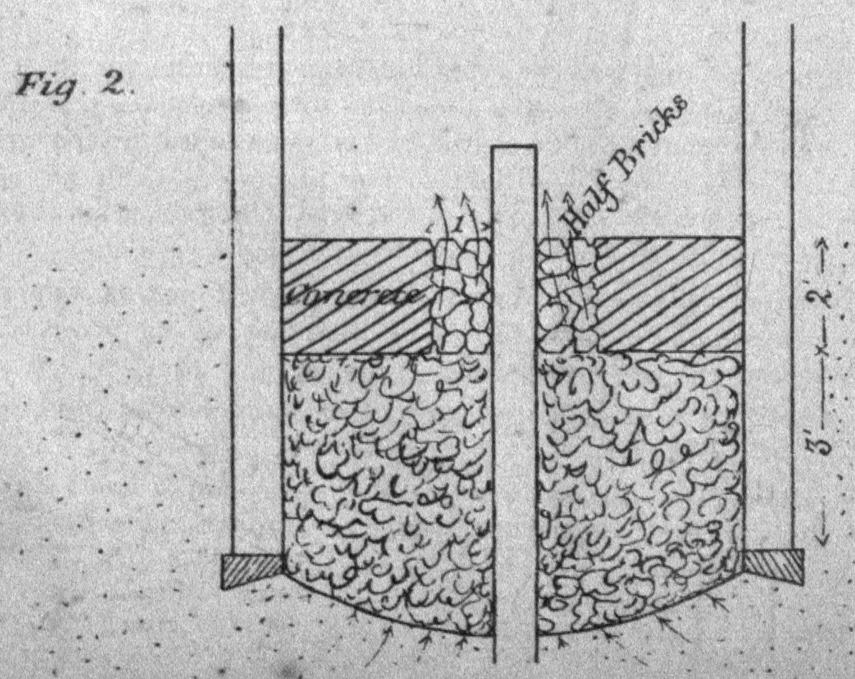
15. The fourth plan, which has been adopted, appears most promising. The plugs of broken brick which were put into some of the wells did not keep out the

sand when the water surface was lowered more than four feet Fig. 1 shows the section of the bottom of one of the wells—



When the well is worked water flows from the sand through the interstices between the pieces of broken brick, and it is evidently easier for the water to pass between the plug and the cylinder than through the centre of the plug. On this account more water is drawn from the sand immediately under the curb than from that in the centre, and when the head exceeds about 4 feet the sand under the curb comes in with the water and the cylinder sinks.

16. To prevent this the wells have been furnished as shown in fig. 2 :—



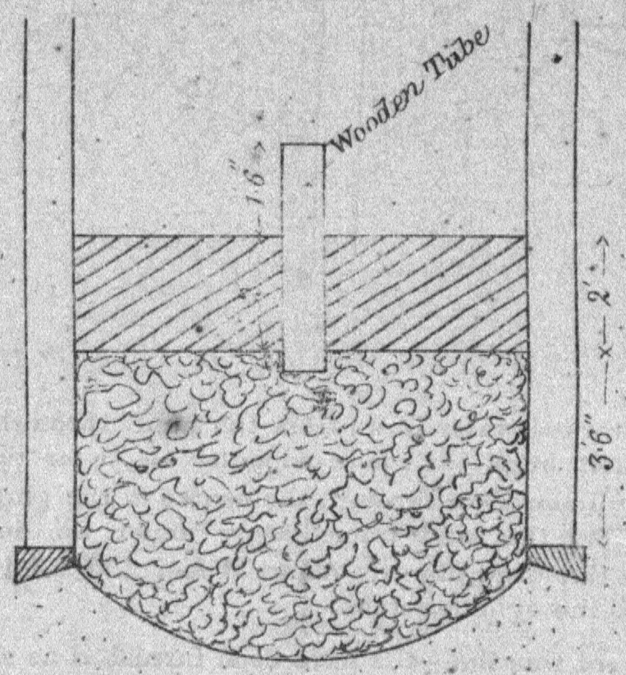
The cylinder having been cleaned out broken brick and lime siftings are thrown into it to a height of three feet above the curb, that first used being small enough to pass though a ring about half inch in diamater and the size being gradually increased to 1½ inch ; upon this half bricks are put round the pipe to a distance of one foot from it, and between this and the cylinder concrete is rammed. The concrete is 2 feet thick.

The concrete prevents the water ascending vertically along the inner face of the cylinder and forces it through the plug of broken brick, thus reducing the action on the sand immediately under the curb.

17. Out of the 14 Hasanpur wells, numbered 9 to 22, 13 have been completed in this way, and only one Ekhonda No. 1 remains to be finished.

18. The iron pipe in the well No. 1 of Karnpur has broken off 2 feet and 6 inches above the curb. The pipe is on sand, and in a trial that was made in 1881 the pipe became about half full of sand and gave little or no water. As the iron pipe will be useful in making trial *borings*, it has been decided to withdraw it, and diving apparatus has been sent to Moradabad partly for this and partly for the repair of three wells which are cracked below water-level. When the pipe has been withdrawn the well will be finished as shown in fig. 3 :—

Fig. 3.



Broken brick and lime siftings will be thrown into the cylinder to a height of 3 feet above the curb, as in the other wells; a wooden tube 4 feet long will thus be fixed vertically in the centre of the cylinder on the ballast, and more broken brick will be thrown in to a height of six inches. On this two feet of concrete will be rammed. The object of throwing the six inches of broken brick into the well after the pipe is fixed is to prevent the concrete getting under the tube and stopping it up.

One of the Awa estate wells at Jaithra has been finished in this way and has proved successful, the well, which is only five feet in diamater having given water for two small buckets during the last three months.

19. Up to date only four wells have been tested, the concrete in the others not having set.

The Padli well, in which the tube has been sunk to clay and a concrete plug has been rammed between the tube and the masonry, gave the following results :—

Water surface lowered	2 feet,	discharge	70	cubic feet	per hour.	
Ditto ...	4 „	ditto	91	ditto	ditto.	
Ditto ...	5 „	ditto	178	ditto	ditto.	

20. Three wells with permeable plugs (fig.) 2 have been tested:—

Sahadra well—

Water lowered	2 feet,	discharge	132	cubic feet per	hour.
Ditto	3 ,,	ditto	250	ditto	ditto.

Karnpur (No. 2)—

Water lowered	1 foot,	discharge	54	cubic feet per	hour.
Ditto	2 feet,	ditto	103	ditto	ditto.
Ditto	4 ,,	ditto	196	ditto	ditto.
Ditto	4 feet 7 inches	ditto	239	ditto	ditto.

Ekhonda (No. 2)—

Water lowered	2 feet,	discharge	84	cubic feet per	hour.
Ditto	4 ,,	ditto	120	ditto	ditto.
Ditto	6 ,,	ditto	199	ditto	ditto.

No sand came into the cylinders during the trials. Each of these wells gave a better discharge than the Padli well with a concrete plug, although the tube of the latter had reached clay. This would appear to show conclusively the advantage of the permeable plug in these wells.

21. The following work remains to be done on Hassanpur wells. The two wells in Ekkonda (No. 1) and Karnpur (No. 1) are to have permeable plugs put into them, and three wells—*viz*, Sadhpur, Kishangarh, and Manota—the cylinders of which are cracked, require to be repaired. Diving apparatus has been sent to Moradabad and the whole of the work should be finished by the end of this month.

22. Out of the 17 wells in the charge of Muhammad Mohsin Khan masonry work has been commenced on only 14. These have all been cleared out and their measurements are given in statement C. Two wells which have been commenced by the zamíndár of Keshopur Bhandi are included in the same statement.

23. In two of the Amroha wells wooden tubes have been sunk. The tube of the Rájabpur well was cleaned out. It apparently rests on sand.

The tube of the Jagwa well could not be cleaned out. The villagers say that some iron tools had fallen down it and could not be removed.

24. Of the remaining 12 of the Amroha wells the cylinders have been sunk to depths varying from 6′ 7″ to 18 feet. One cylinder has been sunk 18 feet, another 13′ 7″, 6 from 11′ 10″ to 13 feet, three from 9′ 5″ to 10′ 5″, and one only 6′ 7″.

From statement B it will be seen that nearly all the Government wells were sunk over 16 feet and some of them over 20 feet.

25. Trial borings have been made in all the Amroha wells, and the results are shown in statement B. Mota has been found in only three wells, *viz.*, at Mithanpur, Adampur, and Miran Sarai. The cylinder of the Mithanpur well is on soft mota and there are altogether 14′ 7″ of mota below the curb. As the clay on which the curb rests is soft it may be advisable to drive a wooden pipe through it to the hard mota, to prevent the clay being broken away by the water. Concrete should be rammed round the pipe to a height of two feet above the curbs and the well will then be finished. At Adampur there is a bed of clay three feet thick at a depth of 19′ 9″ below the cylinder. The discharge of the well will be increased if a wooden pipe is sunk into the clay and a concrete plug is put into the cylinder, as in the Padli and Manota wells.

The cylinder of the Miran Sarai well is on soft mota, but there appears to be only one foot of it below the curb, though the cylinder has been sunk only 6′ 7″.

The well should be worked as it is for a time, and if it is does not give water, it must be sunk deeper and converted into a percolation well (fig. 3).

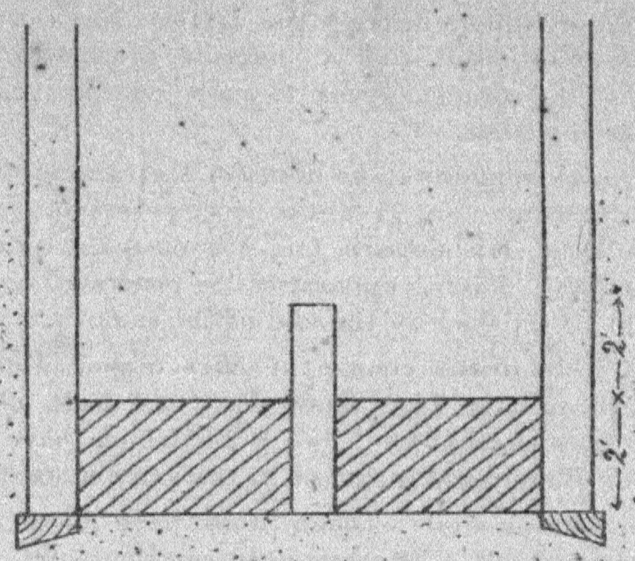
26. The two wells at Rájabpur and Jagira Kalan, in which wooden tubes have been sunk, should be furnished with permeable plugs (fig. 2); but owing to the depth of water in the cylinders being less than in the Government wells, the height of the broken brick above the curb may be made 2′ 6″ and the concrete may be 1′ 6″ thick.

27. The seven wells numbered 3 to 7, 9 and 10, may be completed according to fig. 3; but in all except No. 10 (No. 2 of Jager) the ballast and concrete should each be reduced six inches in depth, owing to the cylinders of the wells not being deep enough.

28. The cylinders of the remaining three wells have been sunk only 9′ 6″ to 10′ 5″. I would recommend well No. 11 being completed with only one foot of broken brick above the curb and 1′ 6″ of concrete.

It would be a useful experiment if Nos. 12 and 13 were completed with a concrete plug and wooden pipe in the centre and with no ballast under the concrete. If the bottom of the well is below the curb sand may be filled into its level with the curb. A wooden pipe 4 feet long should be supported in the centre of the well, with its lower edge exactly level with the curb, and concrete should be removed round it to a height of 2 feet (fig. 4):—

Fig. 4.



The well will practically be a spring well with a very small mota, and an experiment of this kind is required to ascertain what amount of water such a well will give without affecting the stability of the cylinder. If it gives as much water as those furnished as in fig. 3, it will show that there is no use in putting the broken brick under the concrete.

If it is decided not to make these experiments, the cylinders of the three wells Nos. 11 to 13 should be sunk to a depth of 15 feet and they should be finished as in fig. 3.

29. Besides putting plugs into these wells as described above, the following work remains to be done :—

The cylinders of Nos. 1, 2, and 8 are unnecessarily high and should be lowered.

The cylinder of No. 4 must be raised about 4 feet, of No. 7 about 22 feet, and of No. 12 about 18 feet.

Some earthwork also remains to be done.

Besides the 14 wells the cylinders of which have been built and sunk, the shafts of two wells have been dug. At Basira Thagar a few bricks are at site. At Awa there are no bricks.

Trial borings have been made in each of these sites.

30. At Awa the section below the level of subsoil water is as follows :—

Sand	42′·0
Kankar	1′·6″
Sand	6′·6″
Kankar	1′·6″
Sand	0· 6″
Total ...	52′·0

At Basira Thagar the section is :—

Sand	28′ 6″
Clay	0 2
Sand	9 11
Clay	0 3
Sand	11·5
Total ...	50′·3″

If wells are made in these sites they should be percolation wells with dry brick steining.

It was proposed to build a well at Sikri, but the site has not been fixed as no boring could be made.

31. A bed of clay 2′ 2″ thick has been found in well No 1 of Keshopur Bhindi at a depth of 39′ 10″ below the bottom of the cylinder. A wooden pipe may be sunk to it and the well may be fitted with a permeable plug as described in paragraph 26. If it is decided not to incur the expense of sinking the pipe the well may be finished as described in paragraph 26.

No clay has been found in the other well of Keshopur Bhindi, and it should therefore be finished as described in paragraph 26.

Some masonry and earthwork remain to be done in both these wells.

32. When these wells were started, the fact that masonry wells as ordinarily constructed would give a scanty supply of water unless they reached clay and obtained their supply from a sandy stratum below it was as well known as it is now.

There were some 600 masonry wells in the Hasanpur pargana, but it is stated that only two of them had reached mota. The remainder obtained their supply by percolation from the sand at the bottom of the cylinders. Most of them had been sunk about 10 or 12 feet; a few had been sunk 20 feet. It was known, therefore, that the mota was not commonly found within 15 or 20 feet of the water-level, as it is in many parts of the province, but it was expected that it would generally be found within 50 or 60 feet.

The first work done was to make a trial boring in an old well at Hasanpur, and a thick stratum of clay was found at a depth of 54 feet below the level of subsoil water. The boring was made with the tools ordinarily used and proved very expensive. It proved nearly as cheap to sink the large pipes required for permanent use as the small pipes used for testing the strata. No more trial borings were made, but the cylinders were constructed and pipes for permanent use were sunk in them. Had it been anticipated that such great depths of sand without clay existed generally over the pargana the wells would not have been built; but the only trial boring that was made confirmed the general opinion that clay would commonly be found within 50 or 60 feet. It was considered better to risk a few failures (see note by Captain Bellasis) than to saddle each well with an expensive trial boring.

33. In well No. 1 of Karnpur the pipe has been sunk 105 feet and in nine other wells the pipes have gone down over 50 feet below the water-level without reaching clay.

34. It is probable that the failure to find clay is partly due to the use of wooden tubes in nearly all the wells. These tubes can be sunk easily in sand; but when kankar is reached, it is necessary to cut it away from under the sides of the tube, and the wooden pipes being two inches thick, this is difficult. All the tubes have become crooked when they have reached kankar.

Had iron pipes been used they could have been sunk through kankar, and it is probable that some of them would have reached clay. In many of the trial borings at Jaithra a stratum of *nunhar* kankar has been found overlying the mota.

35. Before work was commenced the prevalence of sand in the subsoil was so well known that it was proposed to build percolation wells with dry steining instead of ordinary masonry wells. Mr. Alexander, however, reported that the zamíndárs and cultivators were unwilling to come to any agreement about the payment for such wells, as they did not think that they would give enough water.

The same prejudice still exists. Perhaps the best way to get rid of it is to build a few of these wells in villages under the Court of Wards.

APPENDIX III.

Memorandum showing total expenditure and receipts of the Department of Agriculture and Commerce, North-Western Provinces and Oudh, during 1883-84.

Heads of charges.	Budget expense.	Budget receipts.	Actual expense.	Actual receipts	Net expense.	Savings on budget grant.
	Rs a p.	Rs. a. p	Rs. a p	Rs a. p	Rs a. p	Rs. a. p.
Office establishment ...	24,384 0 0	*Nil.*	23,730 6 3	*Nil*	23,730 6 3	653 9 9
Office contingencies ...	8,039 5 0	...	7,788 13 8	...	7,788 13 8	250 7 4
Office travelling allowance.	3,000 0 0	...	2,333 9 7	...	2,333 9 7	666 6 5
Oudh office establishment.	1,200 0 0	...	1,029 8 5	...	1,029 8 5	170 7 7
Gházipur tobacco farm,	5,200 0 0	6,500 0 0	3,628 5 1	†9,750 0 0	*Nil.*	1,571 10 11
Reh and glass experiment contingencies.	22,624 0 0	*Nil.*	3,110 10 0	447 10 3	2,662 15 9	19,079 8 5
Reh and glass experiment establishment.	2,376 0 0		2,809 13 7	*Nil.*	2,809 13 7	
Traffic registration ...	20,292 0 0	...	12,508 1 1	...	12,508 1 1	7,783 14 11
Cawnpore experimental farm contingencies.	11,754 0 0	4,000 0 0	8,580 1 3	2,746 8 6	5,833 8 9	3,173 14 9
Cawnpore experimental farm establishment.	4,746 0 0	*Nil.*	4,643 11 3	*Nil.*	4,643 11 3	102 4 9
Cawnpore experimental farm workshops.	6,797 2 6	2,000 0 0	6,794 5 0	5,814 0 6	980 4 6	2 13 6
North Indian manufactures.	5,000 0 0	5,000 0 0	1,252 4 5	1,278 10 0	*Nil.*	3,747 11 7
Bull fund imprest ...	*1,330 15 4	*1,330 15 4	3,343 11 4	3,193 1 0	150 10 4	*Nil*
Seed imprest ...	2,000 0 0	2,000 0 0	3,043 15 11	2,395 4 4	648 11 7	*Nil.*
Well fund	5,000 0 0	*Nil*	3,461 6 1	*Nil.*	3,461 6 1	1,538 9 11
Lucknow farm contingencies.	2,636 0 0	500 0 0	280 9 6	480 11 10	*Nil.*	2,355 6 6
Lucknow farm establishment.	864 0 0	*Nil.*	505 0 0	*Nil.*	505 0 0	359 0 0
Total ..	1,72,43 6 10	21,330 15 4	88,844 4 5	26,105 14 5	62,086 8 10	41,455 14 4

* Less Rs. 669-0-8 written off the imprest during the year.

† Includes Rs. 3,250, receipts of the previous year.

ORDERS OF GOVERNMENT.

No. $\frac{407}{1-218}$ OF 1885.

FROM

THE CHIEF SECRETARY TO GOVERNMENT,
N.-W. PROVINCES AND OUDH,

To

THE OFFG. DIRECTOR OF AGRI. AND COMMERCE,
N.-W. PROVINCES AND OUDH.

DATED ALLAHABAD, THE 6TH MARCH, 1885.

SIR,

REVENUE DEPARTMENT.

I AM directed to acknowledge the receipt of your No. 47G. of 28th January, 1885, being the annual report on the operations of your Department for 1883-84.

2. Most of the matters therein dealt with have formed the subject of separate and special reports or letters to the Government, and there is in consequence little in the present report which calls for fresh notice. You did not take charge of the Department till the middle of August last; and it was held during the greater part of the year by Mr. W. C. Benett, whose ability and prudence in the administration of the Department are well known to the Government.

3. In what is perhaps the most important work of the Department, the maintenance and improvement of village records, steady progress has been made. A considerable amount of extraordinary work was imposed on the Department, and well carried out, (chiefly by Major Pitcher) in connexion with the Calcutta Exhibition, and by the special inquiries necessitated by the near approach of the time for revising the land-revenue settlements in Jhánsi and other districts. Notwithstanding this, the work of the kanúngo and patwári staff in 30 districts was brought under supervision, its defects and deficiencies brought to light, and much excellent work disclosed. The patwáris' schools which came into existence during the year under report had not progressed sufficiently far to yield decisive results, and the effect of a longer experience will be awaited. The proportion of unqualified kanúngos in the North-Western Provinces has fallen to 8·5 per cent. In Oudh it is still 34, and in other respects the organisation in that province shows signs of the recent introduction of the system. The imposition on supervisor kanúngos of work not sanctioned by the rules, and the employment of patwáris by landlords on private business, to the detriment of their official duties, should have been specially reported for the orders of Government in the Oudh Revenue Department. The pargana-book has now been adopted in the North-Western Provinces in its revised and approved form, and a first step has thereby been taken towards effecting an analysis and classification of secure and insecure areas.

4. The extension of arboriculture which has been effected by district officers under the general supervision of your Department is indicated by

a substantial increase in the mileage and acreage under operations and in the enhanced receipts from existing groves and avenues. You propose to substitute grafted varieties for the ordinary country mango in road-side-planting. But it should be remembered that in avenue-planting the prospective income to be derived from fruit is only a secondary object, and that grafted mangoes do not usually attain the proportions necessary for a good shade tree, while the tree is also believed to be comparatively short-lived.

5, The other matters contained in sections IV, V, VI, and VII have been separately noticed or are under consideration. Two valuable appendices have been contributed to the report by Mr. W. J. Wilson, late Executive Engineer attached to the Department. In these he narrates the progress which has been made in the reh survey and experiments and in well-sinking in the Moradabad district. The funds at your disposal for the former purpose are now nearly exhausted, and it will be necessary for you before long to sum up the result of past operations and expenditure. In the case of the Moradabad wells, I am to inquire how much longer operations are likely to be prolonged, and whether arrangements cannot soon be made for bringing them to a conclusion and disposing of the wells. The Lieutenant-Governor and Chief Commissioner takes this opportunity of acknowledging the excellent service done by Mr. Wilson while attached to the Department of Agriculture and Commerce.

I have the honor to be,

SIR,

Your most obedient servant,

J. R. REID,

Chief Secy. to Govt., N.-W. P. and Oudh.

REPORT ON THE OPERATIONS

OF THE

DEPARTMENT OF AGRICULTURE AND COMMERCE.

NORTH-WESTERN PROVINCES AND OUDH,

FOR THE YEAR ENDING 30TH SEPTEMBER, 1885.

ALLAHABAD:

NORTH-WESTERN PROVINCES AND OUDH GOVERNMENT PRESS.

1886.

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REPORT ON THE OPERATIONS

OF THE

DEPARTMENT OF AGRICULTURE AND COMMERCE, N.-W. PROVINCES AND OUDH,

For the Year ending 30th September, 1885.

No. 726½G. OF 1885.

FROM

DONALD SMEATON, ESQ., M.A., C.S.,

Director, Department of Agriculture and Commerce,

N.-W. Provinces and Oudh,

TO

THE CHIEF SECRETARY TO GOVERNMENT,

N.-W. PROVINCES AND OUDH.

Dated Cawnpore, the 22nd December, 1885.

SIR,

I HAVE the honor to submit for the consideration and orders of His Honor the Lieutenant-Governor and Chief Commissioner the report of the operations of this Department for the year ending 30th September, 1885.

SECTION I.

MAINTENANCE OF VILLAGE RECORDS.

NORTH-WESTERN PROVINCES.

The work of this Department during the year 1884-85 under this section has been carried on in accordance with the revised (1883) rules for patwáris and kanúngos. Several modifications in the headings of some of the more important of the statistical registers had been prescribed. These modifications have been carried into effect during the past year, and the entries are now made in accordance with the new headings in all districts.

Registers for the use of kanúngos in the permanently-settled districts have been printed and supplied.

2. In connection with the record work of patwáris and kanúngos, the following circular orders have been issued with the sanction of the Board of Revenue :—

(i) That the khasras, being the bulkiest of patwáris' papers, shall be retained in the tahsíl instead of in the sadr record office as heretofore. An amendment to Rule 24, Patwáris' Rules, has been issued accordingly.

(ii) That the khasra, jamabandi, and bujharat of the permanently-settled districts shall be retained for a term of 15 years, and the khewat for 20 years.

(iii) That diaries and field registers of supervisor-kanúngos shall be kept for four years only.

(iv) That for facility of reference a column shall be added to the registers of proprietary mutations, showing the serial (khewat) number of shares transferred.

3. The forms for agricultural statistics which had been current since 1866 have been superseded by a more complete set of forms devised by the Statistical Conference held in Calcutta in 1883. The new forms have now been adopted for the

Provincial Annual Administration Report. It will take another year before all the information which these forms seek to embody can be obtained and thrown into the required shape. But it is hoped that by that time compilation of the statistics under the new heads will be feasible in every district, not excepting the hill tracts of Kumaun and Garhwal and Jaunsar Báwar, which will be able, it is believed, to contribute reliable approximations at any rate under most of the important heads.

4. During the year under report the following additions to the kanúngo establishment were made :—

Assistant registrars	14
Muharrirs for sadr kanúngos	5
Peons for ditto	6

These additional appointments were rendered necessary by the introduction of the (1883) revised rules.

5. During the year the printing and supply of patwáris' forms under the control of this Department continued as heretofore. But it was found that the custom of giving contracts for the printing of these forms to a number of local presses resulted in excessive expenditure, considerable waste, and in some districts inferior work. Endeavour has accordingly now been made to concentrate the printing of these forms in two large private presses under the direct supervision of this Department, and at rates which will, it is hoped, effect a very material saving. Other economies, such as the substitution of thick paper for the kharwa covers and the distribution direct to tahsíls of the forms, will, it is believed, add to this saving.

6. During the year under report patwári schools were opened in Dehra Dún and Gházipur. There is thus now a patwári school in each district of the North-Western Provinces except Kumaun and Garhwál, and there are, in addition, branch schools at Karwi (Bandá) and Sitarganj (Tarái). The following are the most important statistics of these schools summarized for the year under report and also last year :—

	1883 84.	1884 85.
Average attendance of patwáris	899	1,189
" " of candidates	174	315
Total cost ... ... Rs.	4,351	13,990
" receipts ... ... "	779	7,273
" number examined since October, 1883 ...	330	3,946
" " passed in all subjects since October, 1883.	219	2,193
Number of patwáris yet to attend		14,178

During my inspection tour in the Rohilkhand Division, I found that a large number of patwáris, who had been only four or five years in charge of circles, had been exempted from attending school, although comparatively few of them knew how to correct maps in even the most rudimentary fashion. Exemptions were thereupon, with the sanction of the Board, restricted to patwáris of 50 years of age or of 10 years' service. This has, of course, increased the number of school-going patwáris. Unless the patwáris are rendered fit by training to map out boundaries of fields correctly and turn out correct areas, there can be little hope of correct village statistics.

7. **Re-arrangement of patwáris' circles.**—*Basti.* Re-arrangements of patwáris' circles in all the five tahsíls of the district have been completed.

Gorakhpur.—Re-distribution of patwáris' circles has been provisionally sanctioned. Certain points remain to be settled before final sanction is given.

Jaunpur.—Proposals for re-arrangement of patwáris circles have been sanctioned. Revised halkabandi is awaited.

Mirzapur.—Revised halkabandi, together with the revision of kanúngos' circles, has been finally sanctioned.

Gházipur.—The re-arrangement which was proposed was sanctioned. But the detailed halkabandi statement submitted with the proposals is still under consideration, the difficulty being the large number of mahâls (average 51) in each patwâri's circle and the heavy writing work entailed by the peculiar (talukawar) tenure prevalent in this and the other permanently-settled districts. It is a question whether certain of the patwâri rules should not be modified, or indeed abolished, so far as the permanently-settled districts are concerned. The Commissioner of Benares, concurring generally with the Collectors of Gházipur and Ballia, has pronounced in favour of certain material modifications of the rules for the permanently-settled districts of his Division.

Ballia.—Proposals for the re-arrangement of patwâris' circles in the whole district have been submitted to the Board. The proposals for parganas Lakhnesar, Kopachit West, and Tappa Dhaka, which had been previously sanctioned, have been revised by the Collector and resubmitted.

Benares.—Proposals for redistribution of patwâris' circles and allotment of kanúngos have been received. The Board of Revenue, however, have called for further detailed statistics regarding the proposed circles, and until the Board have received and approved of these the new arrangements cannot be carried into effect.

Dehra Dún.—The scheme for re-arrangement of patwâris' and kanúngos' circles for the Eastern and Western Dún has been revised as directed by the Board and submitted for sanction.

8. Some minor re-arrangements of patwâris' and kanungos' circles have also been sanctioned during the year under report. They are as follows :—

Garhwál district.—An extra circle sanctioned.

Etah.—A circle for which the zamíndárs have engaged to pay Rs. 7 per mensem has been sanctioned.

Pilibhít.—Tahsíl Puranpur has been subdivided into two supervisor kanúngoships. No additional cost entailed.

9. **Maps for supervisor-kanúngos.**—It was reported last year to the Board of Revenue that if printed maps could be supplied from the press without debiting the cost to the patwâri budget, sections 117 and 118, Kanúngo Rules, could be carried into effect. The Board in reply offered to have copies made in their office on transfer-paper. Accordingly, copies of the settlement maps have been forwarded to the Board's Office from certain tahsíls of Fatehpur, Meerut, and Bijnor.

10. **Reproduction of village maps for the use of patwâris.**—An allotment sufficient to carry on reproduction of the maps on *latta* cloth by means of a wooden frame with muslin stretched on it having been sanctioned in the patwâri budget for 1885-86; circular instructions were issued to all District Officers to encourage this mode of copying among the patwâris of their districts.

In certain districts the patwâris have already become very expert in this method of tracing and turn out maps which are superior to the best published maps which I have yet seen issued from the Board's Office. In a number of districts the new method is beginning to take root: and it is now insisted on that no patwâri shall be passed out of school until he has traced at least three maps neatly and accurately on the new system.

11. **Accommodation of village records.**—Inspection showed that the record-room accommodation at the head-quarters of districts was quite insufficient for the annually increasing bulk of records. The Board accordingly directed that the annual khasras should be retained in the tahsíl record-rooms instead of at head-quarters. This has given some small relief, but not nearly enough. I am still strongly of the opinion which I expressed to the Board, that, after retention for four years, the annual khasras may safely be destroyed. It is the bulkiest of all the patwâris' records. All its important statistics are forthcoming in the jamabandis, mahálwar and mauzáwar

registers, and I think it is tolerably certain that when settlement comes round in a district, the Settlement Officer need not and will not consult the khasras.

The khasra statistics are, as a rule, correctly excerpted in the jamabandis. Such errors as occur are not so much in excerpting from the khasras as in totalling the jamabandi entries and entering them in the registers. It would therefore, in my opinion, be a step in the right direction if the annual khasras were to be retained for four years only and then destroyed. The relief to the record-rooms would be enormous. At present the racks of many of the record-rooms are choked up with what is really useless : with no immediate prospect of increased accommodation.

12. **Registration.**—During the year suggestions have been made for combining in the same office the registration of deeds connected with land under the registration law and the record of mutation of proprietary rights under the revenue law and patwári and kanúngo rules. There is a great deal to be said in favour of some such arrangement, for there is no doubt that at present a good deal of registration work is really done twice over. Any scheme, however, for the object desired will require to be very carefully thought out.

13. **Reduction in the kanúngo staff.**—In 1883 it was proposed to equalise the distribution of the kanúngo staff by gradually reducing in those districts where the establishment appeared somewhat in excess of requirements under the rules. It was accordingly decided that 5 registrars and 21 supervisor-kanúngos should be reduced. The 5 registrarships were abolished in 1883-84, and 22 supervisorships (including one in Allahabad on the suggestion of the Collector) were abolished in 1885.

14. **Examination of kanúngos.**—Examinations were held within the year under report in the Meerut, Rohilkhand, and Jhánsi Divisions. Examinations in the other Divisions were held after the close of the year. Two statements are appended, showing (1) the results of the year's examinations, and (2) the total number in all grades who have qualified under the rules.

Results of kanúngo examination in the Meerut, Rohilkhand, and Jhánsi Divisions during the year ending 30th September, 1885.

	Examined	Passed in all subjects.	Passed in some subjects.	Failed in all subjects.
Sadr kanúngos	...	...	...	...
Registrar-kanúngos	1	...	1	...
Supervisor-kanúngos	11	5	5	1
Candidates	70	23	45	2
Patwári teachers	4	4	...	...
Assistant patwari teachers	3	1	2	...
Ditto registrar-kanúngos	11	4	6	1
Ditto sadr ditto	1	...	1	...
Total	101	37	60	4

	Total number	Total number passed.	Total number as yet unpassed.
Sadr kanúngos	34	32	2
Registrar-kanúngos	180	164	16
Supervisor-kanúngos	444*	413	31
Total	658	609	49

* The following have come under reduction under the orders of Board :—

Muzaffarnagar	3
Muttra	3
Agra	4
Azamgarh	5
Cawnpore	6
Allahabad	1
	22

15. **Settlements.**—*Lalitpur.*—During the year I inspected the Lalitpur district for the purpose of ascertaining whether a revision of assessment should be made on expiry of the current settlement, and if so, on what method and how far the existing maps and records could be safely accepted as a basis for revision. The report was submitted in August, 1885, but the orders of Government have not yet reached me.

Bulandshahr.—Correction of the village maps preliminary to revision of assessment has been nearly completed. The maps and records of the district now afford fairly correct material for the coming revision.

Sahâranpur and Muzaffarnagar.—The current settlement in these two districts will shortly expire. During the cold weather I hope to be able to report on the prospects and method of the coming revision of assessment in both districts.

16. **Occupancy rights.**—The question of the growth or decline of occupancy right in the North-Western Provinces has been under examination during the year. The Board called for statistics from districts based on the ("classification of holdings and rental") tahsíl registers, and desired me to state my opinion. The conclusion at which I arrived, both from the district statistics and my own observations, is that if occupancy right is growing, it is growing very slowly and not very steadily, and in some parts of the country it is distinctly declining. Zamíndárs are fully alive to the unwisdom, from their point of view, of allowing privileges to grow up, and in most districts they leave no legitimate means untried to arrest their growth.

17. **Inspection of districts.**—Of the 37 districts in the provinces 26 were inspected, wholly or in part, by myself and Colonel Pitcher, Assistant Director. Mír Muhammad Husain, Officiating Assistant Director, inspected the Mainpuri district.

The following are summaries of the results of the inspections:—

Moradabad.—The field and office work was not statisfactory in any tahsíl: many errors in crop entries and in entries of possession were found; the maps were not brought up to date and many were in very bad condition. As to the office work, serious arrears were found in Amroha and work was incomplete and behind-hand in the other tahsíls.

Sahâranpur.—The tahsíl registers were not so accurate as they should have been, but the errors were not so serious as had been previously reported. The Collector had set himself vigorously to put them in order. The maps of the district were found not in accord with altered topography and changed field boundaries, and special measures have been commenced, under an Inspector of this Department, to remedy this defect. I must, however, here again point out that the errors were not so serious as had been previously reported. The patwári school was in a flourishing and satisfactory condition, both as to attendance and as to the quality of instruction given.

Budaun.—The field and office work of the sadr tahsíl was inspected. A large proportion of errors was found in field work and maps were found to be incomplete in their record of changes. In the tahsíl registers errors were found in the mahálwar entries, and the new headings had not yet been brought into use. The Collector was doing his best to bring the work up to par. The patwári school was found to be in good working order.

Bareilly.—The registrar kanúngo's work at Aonla was inspected with the result that delay in carrying on work correctly under the new headings had to be brought to notice.

Aligarh.—The office and field work of two tahsíls was inspected. The registers were fairly up to date. The village maps, however, were found far from satisfactory. In a great many cases I found altered field divisions not shown and crop entries incorrectly made. The maps, too, were in bad condition, frequently torn and unfit for use in the field. These points were brought to the Collector's notice.

Etah.—The field and office work in tahsíl Etah was inspected. The work of the supervisor-kanúngos was found not up to the mark. They had been late in beginning and in concluding their inspection and testing tours. The registrar's work was in several details incorrect and in arrear, due to his unfitness from age and ill-health.

Agra.—The registers of 7 tahsíls were inspected, and the field work in 57 patwári circles. On the whole the work was satisfactory, save in the correction of maps, which latter had not generally been brought up to date. The sadr kanúngo appeared to have been somewhat remiss and lacking in energy.

Jhánsi.—Tahsíl Jhánsi was inspected. Some errors were found in the registers, which were disfigured by erasure and were not so neat as they should have been. Otherwise the work was found satisfactory.

Lalitpur.—The tahsíl registers and field work of the entire district were examined. The registers were a little behind-hand, but were, on the whole, as fairly accurate as could have been expected in a backward district, where the patwáris and kanúngos had been but little accustomed to accuracy and punctuality. The village maps were, as I pointed out in reporting on the projected revision of settlement, entirely out of date. They showed the condition of the villages at settlement. Since then there had been extensive changes, but these changes had not been brought on to the maps. A strengthening of the kanúngo staff was judged necessary and proposed for sanction.

Muzaffarnagar.—The sadr tahsíl was inspected and the condition of records and field work was found satisfactory, particularly the patwáris' field work. The errors in the registrars' volumes noticed in the previous year have been duly corrected. Holdings of 12 years and upwards were found to be rare.

Meerut.—The Hápur, Meerut, and Sardhana tahsíls were inspected with satisfactory results in every branch of the work. In particular may be noticed the fact that within 12 months the patwáris have been inducted with success into the system of map-tracing on *latta* cloth through muslin frames. The field work, except in a few cases, was found accurate and up to date.

Sháhjahánpur.—Tahsíls Pawáyan and Sháhjahánpur were inspected.

In Pawayan the work of the registrar-kanúngo was found in a backward state, for which the excuses offered were inadequate. Maps, again, were not abreast of changes, large areas of new cultivation still appearing as waste.

In the Sháhjahánpur tahsíl the work was better. For many of the defects noticed in the work the sadr kanúngo is personally responsible. He is not, in my opinion, an efficient head of the district kanúngo and patwári staff. I found also that the tahsíldárs, as a rule, had not been doing much supervision. The absence of this supervision was in marked contrast to the thoroughly business-like manner in which I found most of the tahsíldárs in the adjoining Oudh districts overhauling the work of their kanúngos.

Mainpuri.—Five tahsíls were inspected by Sayyid Muhammad Husain, Officiating Assistant Director. The work was not found to be in very good order. Errors pointed out in the departmental inspection note of the previous year had been repeated, and in the registers generally there were more errors and omissions than were at all excusable. The supervisors' work was also in many cases found in arrear and incomplete. Sayyid Muhammad Husain's detailed report was forwarded to the Collector.

Dehra Dún.—Progress had been made in organizing the kanúngo establishment. The patwaris were in possession of excellent maps. A patwári teacher had been appointed, and the Superintendent was taking steps to ensure a fair start being given to the work under the new rules.

Farukhabad.—The whole of the supervisors were called into the sadr, and their registers and returns there inspected on the 17th and 18th April. The offices of the sadr kanúngo and of the registrar-kanúngo of the sadr tahsíl, together with the

work of the patwári schoolmaster, likewise came under review. The work of the sadr kanúngo and of the registrar of the sadr tahsíl was found thoroughly satisfactory, while the results of the patwári school were much above the average. The work of the supervisors had been much impeded during the early part of the past touring season by an epidemic of fever: but on the whole, with three exceptions, there was good work all round.

Cawnpore.—Work inspected on the 27th, 28th, and 29th May at the sadr, the full number of supervisors and registrars, with their returns and registers, attending. In two tahsíls the registrar's work was found not wholly satisfactory. A few minor matters were indicated requiring correction, but the great bulk of the work of the staff throughout was satisfactory.

Fatehpur.—Work of every tahsíl except that of Kakreru tested at office and in field. Work on the whole fair, but a few circles indifferent. Supervisors much employed in extraneous work. Supervision of sadr kanúngo perfunctory, as evidenced by an absence of uniformity in keeping registers and in the way of interpreting the rules.

Bánda —Work tested locally of six tahsíls out of eight, and, on the whole, very fair indeed, though, as usual, the work in one or two tahsíls was far superior to that in others—an indication, of course, of some tahsíldárs having given more attention to the subject than others. Attention had to be called to the way in which an ex-tahsíldár of Badausa had used supervisors for work outside of their proper sphere. The condition of the records in that tahsíl was, as might be expected, much inferior to the rest.

Hamírpur.—Work inspected at the sadr; the whole of the registrars and supervisors attending, with the exception of those of Mahoba, who had already been locally inspected. The work of the whole district, barring that of a single kanúngo (who had been already in disgrace), was found extremely good. The patwári school, to which the Collector has given special personal attention, is probably the most efficient in the provinces.

Allahabad.—The whole of the tahsíls were inspected, mostly locally. In three tahsíls tours had been somewhat delayed through no fault of the kanúngos, and in two others the work was above the average standard. Generally the conduct of tours, the punctuality and correctness of returns and registers, the methods of systematic check, were most praiseworthy.

Jaunpur.—Settlement operations being still incomplete in a portion of the district, there were only three tahsíls to inspect; these were visited between the 20th and 25th February and work found to be progressing fairly, considering that it was the first year of rendering statistics and that a good deal had to be learnt. The pátwari school, however, was found in an unsatisfactory condition.

Mirzapur and Chunar.—The work here was found in a transition state. The survey and record operations have only lately been completed and the circles of both kanúngos and patwáris had only quite recently been arranged. It was found necessary to bring to the Collector's notice at the outset the habit of using supervisors for work outside of their proper sphere. From the touring season of 1885-86 it is hoped that accurate and full statistical records and returns will be prepared.

Benares.—Here, again, settlement work was found to have hitherto absorbed the time and energies of the supervising staff. Most, however, of the kanúngos were examined as to their knowledge of their duties in view of field work commencing under the patwári and kanúngo rules from 1885-86 with satisfactory results.

Gházipur.—The remarks as to Benares apply here, except that more field work had been done and the kanúngo staff had, therefore, already had some training. The supervision had so far been decidedly good.

Ballia.—This district, again, is still partly under settlement. Some of the tahsíls, however, had been completed and had been worked by the kanúngos and patwáris for the past season under the rules. The Rasra tahsíl was inspected on the 8th and 9th March, and the standard of efficiency found very high—indicating very close attention on the part of the district authorities.

Azamgarh.—Every tahsíl of this district was inspected both in office and in the field. Owing partly to an inefficient sadr kanúngo and partly to other causes, the work was found in a very backward and unsatisfactory state in all branches—supervision, registration, and field record. The matter has been brought specially to the notice of the Board of Revenue and taken up vigorously by the district authorities, the sadr kanúngo and the most inefficient of the kanúngo staff having been removed. The services of an experienced Inspector of the Department have been placed at the disposal of the Collector, who has reported that much improvement is to be anticipated from the measure.

OUDH.

18. All the Oudh districts came under inspection. The three districts, Kheri, Hardoi, and Sitapur, were inspected by me : the remaining nine by Colonel Pitcher.

The following are summaries of the results of the inspections :—

Lucknow.—The sadr kanúngo's time had been taken up for the most part by the work of preparing the revenue registers under a special officer. Registrars' work and supervisors' work all found very satisfactory, with the exception of that of one supervisor who was detected in having made a false entry and was promptly punished by the Deputy Commissioner. Arrangements for collecting and abstracting the settlement figures for the opening line of the village registers still to be undertaken and has been, it is understood, put in hand. Patwáris' work good. Patwári school fair, but attendance small, and as nearly all those have passed who are liable to attendance, the school has lately been closed.

Unao.—This district has set an example to the rest in grappling with the task of abstracting settlement statistics by villages for the village registers and is a long way ahead of the rest with those registers. As this district will be the first for re-settlement, it is important that accurate district statistics should soon be forthcoming.

Considerable errors had occurred in the distribution of forms owing to the inefficiency of the sadr kanúngo. The latter has been replaced by a more efficient man from amongst the supervisors.

The registar's work was throughout fairly satisfactory, as was that of the supervisors, with the exception of those in the Purwa tahsíl, in which inferior work on the part of the patwáris appears to have re-acted on the supervisors.

The patwári school, which, until this year, had been the least efficient in Oudh, was found to have made rapid improvement under a new master and under energetic supervision by the tahsíldar.

Bara Banki.—It was only found practicable to inspect two tahsíls out of four. The sadr kanúngo, who had been on probation for a year, had not proved a success, and has consequently since been replaced by a man from the Lucknow district. Owing probably to want of supervision, the work was much below the standard of Lucknow, and more work appeared to have been given to supervisors and also to registrars than is provided for in the rules. The two kanúngos in the Fatehpur tahsíl maintained by a revenue-free grant having proved unfit for their work, the muafi has since been resumed and paid men appointed.

Kheri.—The patwáris had been fairly punctual in lodging their papers. Their kharíf partal had been concluded in time and the rabi partal was in progress. The

supervisors appeared to work just as well as in the North-Western Provinces districts. The maps, however, are not touched. The tracings in the hands of the patwáris are simple copies of the original settlement maps. Waste land which has for years been under cultivation still appears on the maps as blank blocks of waste. Fields whose boundaries have been completely altered are still shown with their obsolete boundaries. It is impossible, therefore, to check the khasra entries with the aid of the map. For correct areas the map should be looked to: if the map is allowed to become obsolete, there is no security that correct areas, especially in newly-broken-up land, have been entered in the khasra. The tahsíl registers were being got into order.

Hardoi.—The work both in field and office in this district was good. The Deputy Commissioner had taken pains, the tahsíldárs were alive to their responsibility, and the sadr kanúngo was active and intelligent. The register work of the two tahsíls examined was accurate and up to date. The remarks about the village maps made in respect of the Kheri district apply equally here.

Sitapur.—The register work in the (sadr) tahsíl examined was scarcely so satisfactory as in Hardoi. But the Deputy Commissioner had taken the business well in hand. Next inspection will probably show improvement. The remarks made about the obsolete condition of the village maps in respect of Kheri and Hardoi apply here. The patwári school appeared efficiently conducted, although the attendance was small.

Fyzabad.—Work all round of sadr kanúngo, registrar, and supervisor greatly improved and now in fair order. In Bhikapur tahsíl kanúngos had been employed by the tahsíldár in work other than that sanctioned by the rules. As to the patwáris' work, a great deal had been accomplished in the way of revising the complex circles here so common, and the work of several of the circles examined was found as neat and accurate as could ever be expected. Though patwáris in this district appear to do a great deal of private accounting for their masters, the talukdárs, the latter mostly keep private ámins well up in survey, who exercise close supervision of a most useful kind over the patwáris and their work. The patwári school is but thinly attended by candidates, all the patwáris liable to examination having passed.

Bahraich.—The staff here generally had far better results to show for their work than hitherto. No thanks, however, to the sadr kanúngo, whose continued inefficiency has since led to his reduction along with that of two kanúngos who had failed to improve. The patwári school of this district has been closed, the instruction of patwáris having come to an end: the excellent schools maintained by the Kapurthala State and by the Mahárani of Balrampur sufficing for the training of candidates.

Gonda.—Work here is still hampered somewhat by the complexity of circles, and by the distance at which many of the patwáris reside from their circles: a large number, for instance, serving in the Tulsipur pargana reside in the district of Basti. Registers in the tahsíls still require settlement figures, and statistics had been entered by tappas instead of by parganas. *Chittas* also incomplete, and recommendations were made to employ the better educated of the kanúngos for office or register work rather than field work. In the supervisors' work the average was good, and only in the Atraula tahsíl had fault to be found that supervisors were given work other than that sanctioned by the rules. The patwári school continues to be a flourishing institution popular with candidates.

Rae Bareli.—The sadr kanúngo, who has seen excellent service in his day, is scarcely now up to the standard, and the necessity for bringing about a change was shown in the registers, which, for the Rae Bareli tahsíl, had important defects. More care on the part of registrars is evidently required in regard to the preparation by patwáris of papers to be filed at the tahsíls. On the other hand, the supervisors, to whose work the District Officer had given much personal attention, had greatly improved. Patwári circles are still much involved, many of the men writing for villages

scattered over two or more supervisors' circles. This is being gradually remedied, but until complete the registers of patwáris remain subject to constant alteration. Attention was called to the necessity for prompt notice by sub-divisional officers of reports by supervisor-kanúngos against patwáris and to the frequent leave granted to supervisors during the camping season. Patwári school fairly maintained, but improvements suggested.

Sultanpur.—A change of sadr kanúngos here since last year has improved matters, but returns are still very late and registrars still behind-hand in the preparation of *chittas* and abstracting of settlement figures, otherwise neatly kept. Supervisors generally had done excellent work. Considerable delay in issuing blank forms had kept back the work of patwáris, but this is not likely to occur again. The extremely complex circles of this district have lately been re-arranged with great labour and apparently excellent effect. A practice in this district is that of moving the patwári school from tahsíl to tahsíl, and the results are satisfactory.

Partabgarh.—On the whole, work here would appear to have less improved than in any other district. The sadr kanúngo is no doubt capable enough, but has not succeeded in enforcing reform to such an extent as is desirable ; and much fault had to be found with the work of several of the supervisors as well as with arrears of work in the registrars' offices. Patwári school in fair order.

19. The annual examinations of kanúngos for the year were held in July and August, and as a result the statement of kanúngos passed and not passed now stands thus :—

Total No.	No. passed.	*No. not passed and exempted.*	
		Over 54.	Under 45.
239	219	16	4

20. **Patwáris' pay.**—On the years from 1882 to 1885 a balance of about Rs. 64,000, remissions due on account of patwáris' pay, remained still unadjusted, which will probably be cleared in the current year.

21. In the matter of forms considerable economies have been effected; the original district estimates of Rs. 50,277, through the co-operation of District Officers, having been reduced to Rs. 25,000 for the years 1885-86, and it is hoped that this may be reduced still further, thus creating a margin from which the pay of insufficiently-remunerated circles may be improved.

SECTION II.

Analysis of Districts.

22. The first step towards making this analysis has now been taken. Pargana-books have been issued to all districts. In these the important statistics of each village will be ledgered annually in English by the registrar-kanúngos. The work has been started in most districts. The form in which the pargana-book is cast is as follows :—

On the first or outer page are recorded what may be called the permanent or *quasi*-permanent statistics of the village, *viz* :—

1. Name of village.
2. Population—adults : males, females ; minors : males, females.
   - Adult-male.
   - „ female.
   - Minor-male.
   - „ female.
   - Total.
3. Total area.
4. Government demand at last settlement.
5. No. of co-sharers at last settlement.
6. Description of tenure.
7. Names and areas of constituent mahâls, if any.

On the inner page are recorded the annual statistics of cultivated area, rent, revenue, rent suits, ejectments, processes for realization of revenue, transfers, status

of tenants, and areas under the various kinds of irrigation. The form in which these are shown is as follows :—

1. Year.
2. Total cultivated area, as in column 6 of the milán-khasra.
3. Total rent demand, as in column 6, Part I, of the mahál register.
4. Total rent collections, as in column 11, Part I, of the mahál register.
5. No. of suits for arrears of rent.
6. No. of ejectment cases.
7. Coercive processes for realization of arrears of revenue { Number. Kind.
8. *No. of transfers.
9. Area of sír, and land cultivated by proprietors, total of columns 3 and 4, Part II, of the mahál register.
10. Area held in occupancy right or for more than twelve years, total of columns 6 and 7a and 8a of Part II, of the mahál register.
11. Irrigated area, as in columns 2, 3, and 4 of the milán-khasra. { (a) From wells. (b) From canals. (c) From tanks or other sources. (d) Total.

When the statistics of a sufficient number of years have thus been brought together, classification of districts and portions of districts according to what may be called their "famine resources" will be to a certain extent possible. A general idea at least will be gained of the comparative resources of districts. But until actual protracted drought has shown how many wells in any district give water and can be worked in the absence of the monsoon rainfall, how far canal irrigation can meet the strain of an excessive demand for water, how far the ordinary village grazing lands can be depended upon to keep the cattle alive without rain, no analysis, however complete, based on the annual village statistics will be a safe guide. In the all-important matter of well-irrigation there is a very great deal of uncertainty. A tract which in ordinary seasons may have ample well-irrigation may find itself in a season of severe drought without a single water-giving well : the wells may either have completely dried up or the water-level may have sunk to an unworkable depth.

23. The Government of India desire that, besides ledgering the annual village statistics, *generalizations for districts be made and shown on coloured maps. This process must be preceded by the preparation of the pargana-book. But in the meantime I propose to instruct the sadr kanúngos of districts to compile in map form, roughly at first, such information under some heads, such as distribution of population, grazing area, communications, average rainfall, products, permanent well irrigation (derived from information regarding the actual area irrigated from wells during the last two seasons of drought), and permanent canal irrigation. The information thus compiled will, like the statistics of the pargana-book, be liable to annual verification by the District Officers and by the officers of the Department of Agriculture : so that in the course of a few years a fairly-dependable array of important facts bearing on the condition of districts may be expected. A sort of beginning has already been made in the completion of a water-level map for the united provinces, but the information which it purports to convey must be accepted with great caution.

*"Series of maps showing the products, distribution of population, grazing area, communications, average rainfall, &c., as well as the irrigation of each pargana."

SECTION III.

System of Collection of Revenue and Rental in Precarious Tracts.

24. Here, again, the information sought must await the preparation of the pargana-book. Facts concerning isolated parts of the provinces could be now given, but this would not be satisfactory. What appears to be wanted is comprehensive information district by district. This will be forthcoming after the pargana-books have made some progress.

SECTION IV.

Measures of Protection, including Arboriculture.

25. The measures of protection which now engage the attention of this Department may be classed as follows :—

(a) Reclamation of usar land.

(*b*) Enclosure of waste lands, experimental at present, with a view to determine whether by such enclosure fodder reserves can be created which will yield a supply of fodder for cattle, particularly in seasons of drought.

(*c*) Cheapening of well-sinking operations and improvements in the method of well-sinking.

(*d*) Arboriculture.

26. The experiments in the reclamation of usar conducted by Mr. Wilson, C.E., on the Áwa estate came to an end more than a year ago. The estate has now passed out of the control of the Court of Wards, but the plantations started by Mr. Wilson are still kept up by this Department till it can be decided whether, and if so, on what terms with the Rája, the plantations should be carried on for a few years more. It was represented to the Board in March last that it would be a pity just at present to surrender the plantations after so much labour and expense had been incurred; and it was proposed to endeavour to obtain the lands on lease from the Rája or acquire them under the Acquisition Act. The Board on this made some enquiries relative to the quantity of land to be taken up, &c., thinking apparently that the proposals related to the entire area of land which had been under experimental operations; whereas it was only proposed to reserve the areas actually under plantations, and which it would, at present at least, be bad economy to surrender. Before replying to the Board's queries I wished to have the advantage of Mr. Wilson's personal inspection of the plantations. He had been the creator of them, and he was the person best fitted to say whether or not they should be kept up for a few years more. It was of no use, of course, inspecting the plantations during the rains, when all would be green and flourishing; so Mr. Wilson decided to visit them in the beginning of the cold weather and report his conclusions. Pressure of other work has prevented him from making out his visit yet, but he hopes to be able to go to Áwa early in the new year. I shall thus be able to report definitely within a month or two.

27. So far the experimental plantations at Áwa have shown—

(i) that usar grass can grow on bad usar if cattle are kept off;

(ii) that where usar grass grows it is useless to plant *babul* trees;

(iii) that in every usar plain there are patches of land only slightly infected, mixed up with the bad usar; and that in the slightly-infected patches *kikar* trees grow fairly well;

(iv) that the Australian salt-bush, *reonja*, and *chaunkar* gave some promise even in bad usar.

The argument for retaining the Áwa plantations is that if experiments are to be further prosecuted, it would cost a good deal both of time and money to prepare new experimental plots; and that for pure experiment it would be best to retain the lands on which the experiments of the last five years had been conducted.

28. The results of Mr. Wilson's experiments at Áwa were accepted as justifying an attempt to reclaim one or two large selected blocks of usar. Accordingly, on Mr. Wilson's suggestion it was decided to acquire two large compact blocks of usar land in the vicinity of Aligarh and to treat them as follows:—

(*a*) the bad usar was to be left for the present for grass only;

(*b*) *kikar* and (if judged expedient) *reonja* trees were to be sown or planted on the less-infected patches.

These plots were not to be experimentally treated at all; they were to exhibit on a large scale the results of the successful experiments on a small scale at Áwa.

29. During the year under report, accordingly, two large usar blocks in the vicinity of Aligarh have been acquired under the Land Acquisition Act. They have been more or less completely fenced in, partly by stone-posts and wire, partly by

ditch. Mir Muhammad Husain has been placed in charge of them with orders to limit his operations to those above described, (*a*) and (*b*) I went over these two plots with the Collector of Aligarh and Mir Muhammad Husain in August last, and hope shortly to be able to inspect them again and see what progress Muhammad Husain has made.

30. The two Cawnpore usar plots are not showing very great results as yet. But the seasons since they were started have not been very favourable, and time should be allowed to them.

31. The question of fuel and fodder reserves has also been this year under examination, independently of the usar reclamation project just described. Opinions differ widely in regard to the utility of such reserves. But it seems, on the whole, expedient to give them a limited trial. Mr. Duthie, Superintendent of the Botanical Gardens at Saháranpur, has been instructed to make a careful tour during this cold weather in the Jumna ravine tracts, with the double purpose of reporting on the botany of these lands and of ascertianing what sort of fodder grasses and trees might be expected to thrive on them, should it be decided here after to make an experimental enclosure of any section. Mr. Duthie has started on this tour, and I anticipate useful results from it.

32. The reh survey is still in progress. The work, which it was expected would be completed by the middle of 1885, has not yet been completed. The records of the survey are for the most part still in vernacular and are very voluminous. Careful abstracts will have to be made when the survey has been completed, probably a year hence, certainly not sooner, after which a report of the results will be submitted. These surveys are confined to 65 villages in the Akrabad pargana of the Aligarh district.

33. The final report on the Moradabad state wells has been already submitted, and this Department has no longer any official concern with them. As I pointed out in the report, it is impossible to say whether the ingenious contrivance of concrete plugging, and the avoidance thus of long and costly excavations in sand, is really the solution, or at any rate one solution, of the problem of well-sinking in sandy tracts until the wells so constructed have been put to the practical test of working. It is only after the cultivators have taken full work for a season out of these wells that a fair opinion can be formed of the prospects of the new method. Hence it was that I advocated encouragement being given to the cultivators to use the wells by allowing them to irrigate their fields from them free of charge for a time. This proposal was, I understand, not sanctioned, and I am not aware how far use has been made of the wells. Probably, however, during this rabi season resort will be had to them to a greater or less extent, and if so, there should be evidence forthcoming by the month of May how far success has been attained. I would recommend that the attention of the Collector of Moradabad should be drawn to the matter.

34. During the year endeavour has been made to encourage the use in districts of the boring apparatus. In February 1885 I addressed District Officers on the matter, pointed out the great benefit, specially in saving useless expenditure of money, which would accrue from our extended use of the boring tools: and I asked them to say whether they could afford, from any funds at their disposal, to purchase sets of these tools. Several districts—Bara Banki, Rae Bareli, Mirzapur, Fyzabad, and Hardoi—offered to purchase sets: others would be glad to have sets, but could not pay. On receipt of their replies, I purchased in all ten sets with the aid of a special grant from the Local Government and the aid of Rs. 1,000 from the Government of India. The following is the distribution which has been made up to date:—

Fyzabad ...	... 1 set.	Muttra ...	... 1 set
Rae Bareli ...	.. 1 „	Saháranpur ...	... 1 „
Hardoi ...	... 3 sets.	Jaunpur ...	... 1 „
Mirzapur ...	... 1 set.		

A corps of apprentices has been trained in the use of the boring tools, and one trained apprentice has been sent to each district which has been supplied.

Including sets previously supplied there are now in all nine sets of boring tools in use in the united provinces. Where they have been really energetically worked, they have been found of real benefit. It is to be hoped their use will extend.

Arboriculture.

35. The total expenditure during the year amounted to Rs. 68,526-5-7, against Rs. 59,873-11-7 spent in the previous year. The receipts amounted to Rs. 33,830-4-4. Thus the total net expenditure to Government for maintenance of avenues, groves and nurseries during the year amounted to Rs. 34,696-1-3, against Rs. 21,588-6-3 in 1883-84. The receipts and expenditure of each Division is shown in the following table:—

Division.	Total expenditure.						Total receipts.						Net expenditure.					
	In 1884-85.			In 1883-84.			In 1884-85.			In 1883-84.			In 1884-85.			In 1883-84.		
	Rs.	a.	p.	Rs.	a.	p.	Rs.	a.	p.	Rs.	a.	p.	Rs.	a.	p.	Rs.	a.	p.
Meerut ...	12,817	11	3	11,521	2	9	11,892	4	9	13,008	0	5	925	6	6	-1,486	13	8
Rohilkhand ...	8,955	6	8	6,317	4	11	4,173	3	5	1,780	15	9	4,082	3	3	4,536	5	2
Agra ...	11,144	6	4	8,774	5	1	4,687	3	6	6,963	5	9	6,457	2	10	1,810	15	4
Allahabad ...	11,781	5	2	10,205	14	11	4,514	7	3	5,971	2	2	7,266	13	11	4,234	12	9
Benares ...	6,067	9	5	5,478	8	9	4,529	12	10	4,312	8	2	1,537	12	7	1,166	0	7
Jhánsi ...	9,549	0	1	9,239	5	10	893	11	7	1,505	6	10	8,655	4	6	7,733	13	0
Kumaun ...	562	1	8	500	0	0	...			...			562	1	8	500	0	0
Lucknow ...	2,942	6	11	2,608	11	1	1,549	0	0	3,488	12	3	1,393	6	11	885	1	2
Fyzabad ...	1,915	7	0	1,408	12	9	251	14	0	434	10	9	1,663	9	0	974	2	0
Sitapur ...	1,793	13	10	2,248	9	2	707	12	0	461	6	6	1,086	1	10	1,787	2	8
Rae Bareli ...	1,697	1	3	1,576	2	4	630	15	0	359	0	9	1,066	2	3	1,217	1	7
Total ...	68,526	5	7	59,873	11	7	33,830	4	4	38,285	5	4	34,696	1	3	21,588	6	3

36. The expenditure and receipts both reached their maximum in the Meerut Division, resulting in a net expenditure of less than Rs. 1,000. The net expenditure is highest in the Jhánsi Division, where a very large sum is spent in keeping up the avenues, and the receipts are comparatively insignificant.

37. The chief sources of income are (*a*) lopping and felling of trees; (*b*) fruit; (*c*) miscellaneous, such as roadside groves, stick-lac, &c. The first item is of course only temporary and cannot last long; the second and the third items may to some extent be looked upon the permanent sources of income, and therefore, wherever the circumstances permit, attempts should be made to extend the planting of fruit trees. The following table shows the income under each of the three sources in all the Divisions of the North-Western Provinces and Oudh during 1884-85 and 1883-84:—

Divisions.	Income from																	
	Lopping and felling.						Fruits.						Other sources.						Total.					
	1884-85.			1883-84.			1884-85.			1883-84.			1884-85.			1883-84.			1884-85.			1883-84.		
	Rs.	a.	p.	Rs.	a.	p.	Rs.	a.	p.	Rs.	a.	p.	Rs.	a.	p.	Rs.	a.	p.	Rs.	a.	p.	Rs.	a.	p.
eerut ..	11,187	1	3	12,058	5	5	702	1	6	949	11	0	3	2	0	...			11,892	4	9	13,008	0	5
ohilkhand,	2,726	1	6	1,198	14	6	232	4	9	216	7	3	1,214	13	2	365	10	0	4,173	3	5	1,780	15	9
gra ...	3,867	5	6	6,073	11	3	505	11	9	610	5	6	314	2	3	279	5	0	4,687	3	6	6,963	5	9
llahabad ...	3,494	1	0	4,741	10	5	777	13	3	884	7	3	242	9	0	345	0	6	4,514	7	3	5,971	2	2
nares ...	1,322	6	1	1,550	7	10	2,615	8	6	2,468	8	0	591	14	3	293	8	4	4,529	12	10	4,312	8	2
ánsi ...	534	0	10	1,188	5	10	139	13	0	55	9	0	219	13	9	261	8	0	893	11	7	1,505	6	10
maun ...	...			...			...			...			...			...			...			...		
cknow ...	1,226	15	3	3,195	5	6	112	0	6	166	9	3	210	0	3	126	13	6	1,549	0	0	3,488	12	3
zabad ..	128	5	6	108	4	3	88	0	0	303	9	0	85	8	6	22	13	6	251	14	0	434	10	9
tapur ...	695	13	3	430	6	6	...			...			11	14	9	31	0	0	707	12	0	461	6	6
e Bareli ...	265	10	3	217	14	6	344	10	9	119	0	0	20	10	0	22	2	3	630	15	0	359	0	9
Total ...	25,447	12	5	30,763	6	0	5,468	0	0	5,774	2	3	2,914	7	11	1,747	13	1	33,830	4	4	38,285	5	4

38. The chief heads of expenditure are maintenance of avenues, groves and nurseries, and cost of lopping and felling. The last item is very insignificant, the total outlay under this head during the year amounting to Rs. 1,263-6-10 only, or less than 2 per cent of the total expenditure. Maintenance of avenues formed the largest item of cost during 1884-85. There were 2,586·8 miles altogether under arboricultural operations, of which 459·4 miles were newly taken up during the year.

In 1883-84, 2,279 miles were under arboricultural operations. The cost of maintenance and the length of roads under operation in each Division is shown in the following table :—

Division.	*Miles under operation.*		*Expenditure.*		
	Planted in previous years, but under operation during this year (*a*).	Planted in current year (*b*)	On avenues planted in previous years.	On avenues planted in current year.	Total.
	Miles.	Miles.	Rs. a. p.	Rs. a. p.	Rs. a. p.
Meerut	291·3	22·7	5,714 10 2	4,714 0 2	10,428 10 4
Rohilkhand	322·7	73·5	4,449 9 10	2,735 11 9	7,185 5 7
Agra	561·4	46·0	7,049 15 8	1,899 15 10	8,949 14 6
Allahabad	237·5	59·2	7,756 7 7	1,645 7 6	9,401 15 1
Benares	169·5	35·0	2,604 10 9	1,477 15 1	4,082 9 10
Jhánsi	220·5	23·5	6,557 11 10	1,583 7 1	8,141 2 11
Kumaun	20·5	0·5	30 0 0	86 11 8	116 11 8
Lucknow	36·0	59·0	1,109 4 6	619 12 5	1,729 0 11
Fyzabad	84·0	7·0	766 12 6	922 14 0	1,689 10 6
Sitapur	198·0	53·0	728 3 5	737 11 11	1,465 15 4
Rae Bareli	86·0	14·0	656 8 9	738 7 5	1,395 0 2
Total ...	2127·4	459·4	37,423 15 0	17,162 2 10	54,586 1 10

39. The extent of area under groves, their number, and the cost of planting and maintaining them are shown in the following table :—

Division.	No. of groves.		Area.		Cost of planting and maintenance.	
	1884-85.	1883-84.	1884-85.	1883-84.	1884-85.	1883-84.
			Acres.	Acres.	Rs. a. p.	Rs. a. p.
Meerut	5	3	40·8	35	830 3 11	150 14 0
Rohilkhand	5	4	3·2	4	6 0 8	62 0 0
Agra	10	7	8·7	8	90 8 0	87 11 9
Allahabad	4	5	3·5	4	622 3 5	412 7 0
Benares	6	4	49·9	41	1,024 4 6	486 12 3
Jhánsi	14	14	43·2	43	303 0 0	244 2 0
Kumaun	...	...	...	...	...	...
Lucknow	...	...	...	...	...	...
Fyzabad	3	3	5·0	5	..	15 13 0
Sitapur	3	3	32·0	32	30 0 0	36 0 0
Rae Bareli	1	...	1·5	...	10 0 0	...
Total ...	51	43	187·8	172	2,916 4 6	1,495 12 0

The figures of 1884-85 show an increase of 15·8 acres in area and of Rs. 1,420 in the cost of maintenance. The increase occurs mostly in the Aligarh and Gorakhpur districts, where 5·8 and 4 acres of new land were brought under groves at an additional cost of Rs. 710-3-11 and Rs. 530-6-7 respectively.

40. One hundred and eighty-one nurseries were maintained during the year, against 167 kept up during the preceding year. The total cost of maintaining them amounted to Rs. 9,760-8-5, against Rs. 7,608-1-4 spent in last year. The number of

trees adedd during the year, the number planted out, and the number in stock at the end of the year are shown in the table below :—

Division.	No. of nurseries.		No. of plants added during the year.	No planted out during the year.	No. in stock at the end of the year.
	1884-85	1883-84.			
Meerut	13	11	24,076	15,124	43 952
Rohilkhand	20	17	19,827	10,677	28,234
Agra	37	36	48,428	19 769	70 317
Allahabad	35	36	38,128	17 5-8	51,457
Benares	24	24	24,192	8,973	35,516
Jhánsi	14	9	11,494	4,129	16,923
Kumaun	2	7	7 649	2,355	4 819
Lucknow...	12	7	31,785	25,890	54 943
Fyzabad	11	8	17,23	1,779	21,271
Sitapur	10	10	1 808	1,153	6,816
Rae Bareli	3	2	6,258	2,784	12,425
Total ...	181	167	2,18,876	1,10,155	3 46,703

41. Opportunity was taken during the district inspections to note the condition of the young trees, with scarcely a single exception, in all the districts and parts of districts inspected, the young trees looked well and bore evidence of being well cared for.

SECTION V.

AGRICULTURE, INCLUDING EXPERIMENTS AND FARMS.

42. *Meerut Demonstration Farm* —In April last, with the sanction of Government, a small "Demonstration" farm of about 20 acres was established at a convenient place three miles from Meerut and close to the scene of the annual "Nauchandi" Agricultural and Horse Fair. The object of this farm is to show in actual operation on the land of an ordinary holding such improved methods of tillage as have been proved by experiment at Cawnpore to be of real value and to be within the reach of any cultivator. The principles on which the farm was to be worked are—

(1) that it is to pay its own way ;

(2) that it is to be managed by a committee of agriculturists of the district with a working Superintendent appointed from Cawnpore.

Accordingly a trained apprentice from Cawnpore was sent as Superintendent and five gentlemen of the district were invited and consented to act as a committee of management. The farm has only been in existence since April, *i.e*, for a single kharif season A full year must be allowed before any judgment be passed upon its results. Meanwhile the committee have sent in a brief report of the kharif operations, which so far are satisfactory and tend to justify the establishment of the farm. They are confident of its paying its way and proving really useful to the cultivators of the sourrounding country and district generally. Visitors have been very numerous, and the Superintendent has been moving about a good deal in the neighbouring villages, making the acquaintance of zamindárs and cultivators. In the past kharif new varieties of cotton (Nankin and Orleans) were sown. The Duplex plough alone was used, the plough-cattle being of exactly the type ordinarily in use all over the country. Green soiling for wheat and ensilage of green fodder during the rainy season were two of the important processes shown actually in operation for the first time and attracted a good deal of attention and interest.

43. Free access was allowed to all who chose to come and see what was going on. The committee met several times in the little farm enclosure. I inspected the farm three times, on the last occasion accompanied by the Committee. Colonel Pitcher inspected it once and Mír Muhammed Hosein once. The kharif crops on the farm were conspicuously superior to those of the surrounding lands. If, as may be anticipated,

the same superiority be attained in the coming rabi—particularly wheat-crops—the evidence afforded to the assembled agriculturists at the Nauchandi Fair of the advantages to be gained by adopting the new methods of tillage will be very strong.

44. *Cawnpore Experimental Station.*—The institution maintained at Cawnpore for pure experiment in the direction of agricultural problems and improvements has long suffered from bearing the misnomer of Farm. This has now been changed to that of the Cawnpore Agricultural Station.

45. The operations conducted at this agricultural station during the year have been duly recorded at length in half-yearly reports.

That for the kharíf (autumn) crops referred to a season characterized by heavy and inopportune rainfall, disastrous alike to cotton and sorghum, the two crops on which, perhaps, in former years the most interesting experiments were carred out. Juár in well-drained positions was alone satisfactory.

Of experiments with various manures, the most noticeable result was the success obtained with woollen refuse, a material which has hitherto proved to the Mills in Cawnpore a serious incumbrance, as it has been difficult to get rid of and, if left to accumulate, is dangerous from its liability to spontaneous combustion. It is now shown practically to the Indian cultivator to be a valuable material for his crops—a fact, it is needless to mention, well appreciated in England. Next in value stood poudrette and then cowdung manure.

Deep ploughing maintained its annual superiority, while this year broadcast sowings of cotton were found more profitable under the peculiar conditions of the season than the method of sowing in drills, in which hitherto the best results have been obtained. Retaining the cotton crop for a second year on the ground and *ratooning* the plants, in which experiments have been conducted for four years may be now judged unprofitable and unsuited to the Duáb.

Nankin cotton continued to receive considerable attention and three varieties were under experiment, but the season was as unpropitious for it as for country cotton, and the results were negative.

The system of cultivating small carefully measured and cultivated plots of every important kharíf crop, the produce of each being carefully weighed so as to obtain annual approximate data of crop yields, was continued with good results.

It is not contended that such data are an infallible guide for the rate of produce throughout the united provinces, but it is believed that they afford good average results, and that the rise or fall of produce in our sample crops fairly indicates the rise or fall for the year throughout the provinces. Ensilage was carried on on a large scale and with considerable success. In fact it may be said, save in minor details, to have passed beyond the region of experiment, and to be now part and parcel of the working of the station. Ensilage stored in September and October, 1884 has been stored throughout the rains of 1885, and is now being served out regularly to the station cattle with good and economical results.

46. The heavy and late rains necessarily affected the rabi season. The young wheat came up too rapidly, and when again irrigation became necessary the canal supply failed. As a result the average yield of wheat fell from 24·2 bushels in 1883–84 to 17·7 bushels in 1884–85, a little more than half of a good average in England.

Extensive and elaborate experiments with manures, natural and artificial, used alone and mixed, were conducted on a somewhat more extended scale than in previous years, and with results confirming former opinion. As in the kharíf, woollen refuse came prominently to the front in value, while as the manure most generally available and giving, perhaps, the best result on expenditure, farmyard manure maintained its wonted superiority vindicating so far the prescience of the

Indian cultivators; but the experiments also go to show how the cultivator neglects much material which now goes to waste rather than incur a little extra trouble. In this category may be classed brick-kiln refuse, cutting and pitting weeds green during the rains or cutting them just before the seed ripens and burning them for ash manure, instead of allowing them to seed and scatter over the country.

In green soiling, again, the extensive series of experiments showed plainly, as the same series have done in former years, that the system, though known to some extent to the cultivator, is not carried out by him to its fullest profitable extent.

The Ville experiments, continued now for four years, have sufficiently illustrated their purpose of demonstrating *in situ* the dependence of cereal crops on nitrogen rather than to other soil ingredients. It will in future be discontinued.

Experiments on the system of cultivating corn in strips with alternate fallow strips, experiments in irrigation, experiments in canal or well irrigation, and experiment and enquiries in regard to the change of colour effected in wheat by various classes of soil all received attention and contributed data of value. Of experiments appearing for the first time may be noted plots sown to test the value of mixed crops of cereals and oilseeds, which so far indicate that the practice affords a larger combined outturn than if the crop were confined to cereals or to oilseeds alone. Another series of 10 plots gives for the first time a comparative view of the yield and profit on a similar number of oilseeds and pulses, in which for the year castor takes the lead and linseed the lowest place.

Of acclimatized and imported seeds eleven varieties were tried; the former proved superior, and a noticeable fact was the high value of Rs. 84-8-0 per acre obtained from country carrot seed.

47. The workshops were maintained throughout the year on the scale of the previous year and the sale of implements may be considered fairly progressive and satisfactory. The Kaisar plough sales fell from 183 to 60; but the Duplex plough, which has replaced it in native favour, found purchasers for 81 in place of 67, and larger sales of Duplex have taken place since the close of the year. Increased plough sales have resulted from a new departure in bringing the plough to the notice of the agricultural community by sending out trained ploughmen in the nick of the ploughing season to selected districts. There they have ploughed alongside cultivators and have demonstrated the facility with which the improved implements can be worked as well as their superiority. The plan has apparently succeeded so well that it is proposed to continue it next season on a more extended scale.

The sale of water-lifts has nearly doubled and that of evaporators trebled, and more orders are now received than the shops can compass. It is, therefore, in contemplation to make over all orders to any private establishment that will carry them out effectively at no higher cost than that at which petty contractors work for the Department.

48. Allusion may be made to two ploughs selected by Mr. W. J. Wilson, C.E., during a recent tour through America, as worthy of trial. The ploughs were duly tried, but were not found superior to the Duplex and were more costly. The latter, therefore, remains at present the best in the field.

49. Dr. Romanis, Chemical Examiner to the Government of British Burma, visited the provinces during the year and took samples of usar soil *in situ* from various localities, the analysis of which form an instructive appendix to the rabi report. The action of alkalis in the soil has the effect apparently of reducing the clay to so close a texture as to prevent proper aëration and filtration, thus rendering plant life impossible. Mr. Wilson's note on his American tour points to similar conclusions as arrived at in America.

50. *Lucknow Gardens.*—Last year it was the Saháranpur Gardens which were wrecked by a hurricane, while this year the Lucknow Gardens were devastated by a hailstorm which caused immense damage. Its immediate effects, however, were probably less than what may be expected in the coming year.

Owing to the storm there was a slight falling off in income. The demand for fruit trees was in excess of supply. In vegetable and farm culture the crops were greatly injured. The demand for acclimatized vegetable seeds continues to increase.

Flower culture, arboriculture, and the exotic plantations were all satisfactory in operation, and the distribution of young trees was on a very considerable scale. Progress was made in laying out plantations of the Arabian date-palm and generally in promoting a knowledge of its value.

Owing to the ravages caused by the storm it was found impossible to hold the usual annual flower show.

51. *Saháranpur Gardens* —Owing to various causes, the chief being the temporary cessation of sales from the hill gardens, income fell off; the distribution of plants likewise showed a falling off, but in seeds there was a considerable increase.

Indents for drugs increased largely, and there are reasons for expecting increase of work in this very useful section.

Vegetable cultivation suffered from excess of rain; still results were fair and success was obtained with a new tuber from New Zealand.

Fruit cultivation, arboriculture, and textile plants received attention. Several interesting additions were made to the gardens, including a new fibre plant from Afganistan, a species of salt-bush from Sindh, the tree otomato from Jamaica, the coca plant, the palm-oil tree, and that yielding Balsam of Peru.

Collections are being made towards the Indo-Colonial Exhibition, which will include specimens of a new hybrid *cotton* from the Gardens and "spider silk" or the webs of a species of spider abundant in the hills which has been held by experts to have valuable properties allied to those of silk.

The report of a tour made by the Superintendent in north-east Kumaun was published during the year. Great and satisfactory progress was made in establishing and stocking the new hill gardens at Arnigadh.

SECTION VI.

Introduction of Agricultural Improvements.

52. Agricultural Fairs and Shows were held at Saháranpur, Aligarh, Bulandshahr, Meerut, Khairabad (Sitapur), Bara Banki, Sultanpur, and Partabgarh.

The usual horse and cattle fair took place at Batesar.

I attended the Batesar, Meerut, Bulandshahr, and Khairabad fairs: Colonel Horseford (then acting Assistant Director) attended at Bara Banki. Mir Muhammad Husain, Officiating Assistant Director, attended at Aligarh, Saháranpur, and also, with me, at Bulandshahr. The other minor fairs were attended by apprentices from Cawnpore.

At all these gatherings opportunity was taken to exhibit the labour, saving contrivances introduced at Cawnpore, and considerable interest was evinced, particularly at Meerut and Bulandshahr.

No pains were spared to instruct the people assembled on these occasions in the advantages of the contrivances exhibited to them, specially the Duplex plough, the water-lift, the new sugar-evaporator, and the chaff-cutter. Exhibitions like these are certainly useful, but they must be backed up by bringing the implements to the fields and homesteads of the cultivators during the seasons when the particular operations concerned are in full swing. A mere exhibition of new implements or labour saving

contrivances at a fair is not sufficient. The people will not thoroughly believe in them till they see them working on their lands or in their homesteads in their own way.

53. The work of awarding prizes at some—indeed all—of the fairs for agricultural produce was not found satisfactory.

People entirely unconnected with agriculture were found winning prizes for produce which they had evidently purchased from the grower. Zamíndárs were found taking prizes for produce which they exhibited, but which had really been grown by their tenants. I found also many prizes being given to the Department of Agriculture and Commerce for Cawnpore-grown produce. In one case I found that a police constable had earned a prize for wheat, although he had never handled a plough in his life! These are all abuses; and I took the opportunity of explaining to the committee that in allowing such they were really defeating the end for which fairs had been established. The prizes for agricultural produce rarely reached the actual grower. This was the cardinal defect in the management, and a very serious one, indeed. The same defect was apparent in other departments of the fairs. Accordingly, with the aid of Mir Muhammad Husain, I have drawn up a series of suggestions (*dastur-ul-aml*) for the management of fairs in all these branches, cattle, implements, produce, and industrial products.

Copies of these suggestions which are in vernacular have been circulated to all the fair committees in the united provinces, and it is hoped that the management in the coming season will show decided improvement Pandit Ajudhia Parshad delivered a most useful and interesting lecture at the Meerut Fair.

54. *Selecti n and distribution of the best soft white wheat-seed.*—In the beginning of the year I applied for a special grant for the selection, cleaning and distribution to cultivators all over the provinces of pure white wheat-seed. A grant of Rs. 1,000 was sanctioned.

My object in applying for this grant was to endeavour to give a stimulus to the cultivation of that kind of wheat which pays best in the European market. The majority of the cultivators of these provinces depend for their supply of seed on the *mahájan*, who is not generally very careful in the kind of seed he supplies. It is very often mixed up with other grain, much of it is of inferior, deteriorated quality. Really pure, plump seed is not often found in the possession of the cultivator. Hence the complaint frequently heard of the inferiority of the wheat sent down to the Calcutta market and the high "refraction" rate current. It appeared of importance at least to try and encourage the use of the very best grain as seed, and with this view the grant was sought and obtained.

Selection, cleaning, and storage were carried on at five centres—Cawnpore, Sháhjahánpur, Meerut, Khataoli, and Muzaffarnagar. In all 891 maunds, or over 73,000lb., were distributed in districts all over the united provinces. Of this amount 500 maunds were distributed on condition of repayment in kind at the rate of 48 seers for every maund supplied.

The remainder was sold for cash.

The demand was greatly in excess of the supply. An advertisement to the effect that a limited quantity of pure soft white wheat-seed was available for distribution on the terms stated was inserted in the Departmental Journal. Indents followed the advertisement rapidly. The total of the indents amounted to 5,548 maunds, or over 45,000lb. We were thus able to satisfy about one-sixth only of the entire demand.

Pandit Ajudhia Parshad of Indalpur and Chaudhri Darb Singh of Aterna (Muzaffarnagar) gave great assistance in selecting, cleaning, storing, and distributing the seed.

55. The following is a list of the other kinds of seeds and quantity distributed during the year :—

		lbs.
Cape oats	... ...	3,360
Carrots and mangold	... ...	45
Sorghum	... ...	1,520
New Orleans cotton	... .	540
Nankin cotton	(1) Acclimatized	860
	(2) Fresh China seed received from the Government of India	2,000
American tobacco	... ...	12

56. Agricutural improvements in the estates under the Court of Wards during the past year have chiefly consisted in the construction of wells, repairing of wells, renewal and deepening of old tanks, construction of new tanks. In a certain number of these estates the work of well and tank-making is under the charge of an Assistant (Court of Wards) Engineer attached to this Department. He submits his projects for the approval of the Collectors concerned, and after sanction has been accorded to them makes his own arrangements within the budget grants for carrying out the works. He is responsible for the completion of the works according to the plans approved. Fair progress has been made during the year, but not so much as I expected.

In a few estates Nankin cotton, Cape oats, lucerne and Guinea-grass were successfully introduced, and in several real progress in grove-planting and in arboriculture generally has been attained.

57. In September a ploughing fair in five selected districts was organized with the object of catching the cultivators ploughing their fields for the rabi and showing them on the spot the new (Duplex) plough working. The districts selected were Gorakhpur, Aligarh, Budaun, Sultanpur, and Partabgarh. Five apprentices from Cawnpore with 22 trained ploughmen were distributed with the full consent of the District Officers among the five districts, and toured in suitable directions and where ploughing going on most briskly. Wherever opportunity offered part of a cultivator's field was ploughed with the new plough, with the result that a very large number of cultivators were enabled to see the implement in full working, drawn by their own cattle, on their own lands. Considerable interest appears to have been excited. One hundred and three Duplex ploughs were sold as a result of the tour. In some cases the price was paid at once: in others permission was sought and granted to pay by instalments. The price of the plough is only Rs. 6.

58. Pandit Ajudhia Parshad showed his accustomed zeal, energy and enterprize in the management of his large estate. An extract from his report is appended to this report, and also an extract from a report by Parmeshari Das of Bara Banki.

SECTION VII.

Registration of Traffic during the year 1884-85.

59. The foreign traffic with Tibet and Nepal and the railway-borne traffic with the British Provinces and Native States were registered during the entire year. In November, 1884, arrangements were concluded with the Traffic Manager, Ganges Canal, and Executive Engineer, Agra Canal, for registration of canal-borne traffic on the same system on which rail-borne traffic is registered. Statements of its traffic are now published every quarter with the returns of rail-borne traffic of the province. Registration posts were started on the river Ganges, Jamna, Gogra, Rapti, and Gumti, on the roads crossing the Panjáb frontier, and on the internal roads of the Meerut Division With the exception of posts at Ballia on the Ganges and at Maniar on the Gogra, which register the river traffic with Bengal, all the road and river posts were subsequently broken up owing to financial pressure before statistics for the entire year could be collected.

60. *Foreign traffic.*—No important change was made in the cordon of posts maintained for registration of this traffic. The total cost of registration during

the year amounted to Rs. 4,631, of which half was met from Imperial revenues. The comparative insignificance of this stream of traffic has been noticed in previous reports, its registration is kept up simply to complete the record of land traffic which India transacts with neighbouring foreign countries. The traffic with Tibet amounted to 1,42,284 maunds, which, compared with the traffic for 1883-84, shows an excess of 2,542 maunds, due to an increased export of grains. The traffic with Nepal amounted to 38,43,854 maunds, which exceeded the traffic of 1883-84 by nearly one lakh of maunds, accounted for by larger imports of timber.

61. *Rail-borne traffic.*—The registration of rail-borne traffic continued on the block system The Rohilkhand and Kumaun Railway and a portion of the Bengal North-Western Railway (Fyzabad to Bahraich) were opened during the year; the stations on the former were all included in the Rohilkhand block and of the latter in Oudh block. No other alteration occurred during the year in the limits of blocks. The total railway traffic which these provinces transacted with the neighbouring British Provinces, Native States, and the ports amounted to 371 lakhs of maunds. This when compared with the traffic of the preceding year shows a decline of 85 lakhs of maunds in exports and of 22 lakhs of maunds in imports. The decrease in exports was caused mostly by a falling off in the exports of cotton, wheat, and oil-seeds to the ports and of sugar to the Panjáb, Rajputana, and the Central Provinces. The deficiency in imports was due mainly to a decrease in the imports of iron from Calcutta. The wheat exports during the previous year were abnormally large, caused by a partial failure of the red winter wheat in America. The exports of wheat during the present year were not much below the average. The cotton and til crops of 1884 were very poor, having suffered considerably from the excessive rains, while the sugarcane crop of 1883 had suffered from drought. The decrease under iron is due to large quantities having been received in the previous year for railway purposes and is not caused by any real slackness in the iron industries.

Exports.	*Lakh maunds.*	*Imports.*	*Lakh maunds.*
Total decrease	85	Total decrease	22
Decrease in exports of wheat to the ports.	45	Decrease in imports of iron from the ports.	13
Ditto cotton ditto	8		
Ditto oil-seeds ditto	5		
Ditto sugar to the Panjáb, Rajputana, and Central Provinces.	5		

62. *River traffic with Bengal*—This is registered at the joint expense of the Governments of North-Western Provinces and Bengal. The total traffic during the year amounted to 16 lakhs of maunds, consisting chiefly of oil-seeds, grains, sugar, and stone exported to Bengal, and of rice and tobacco imported from Bengal.

SECTION VIII.

MISCELLANEOUS.

63. *Octroi.*—At the request of His Honor the Lieutenant-Governor and Chief Commissioner, I conducted during the year a series of enquiries into the working of the octroi in the North-Western Provinces and Oudh. The results of these enquiries were reported to His Honor in June last.

64. *Forecasts of special crops.*—In August, 1884, the Government of India asked to be furnished with the monthly forecasts of the condition and prospects of the wheat crop through the agency of this Department. With the approval of His Honor the Lieutenant-Governor and Chief Commissioner I enlisted over 400 selected zamíndárs in both provinces as volunteer reporters. These gentlemen furnished me with monthly bulletins from which I drew up the provincial forecasts. No official aid of any sort was sought. The entire materials for each of the six forecasts from December to May were derived from the reports of the selected zamíndars. The aid thus received was very useful in many ways. It put me in possession of information in regard to

the condition and prospects of the wheat crop which it would have been hopeless to expect from any other quarter or by any other means : and it gave me the opportunity of consulting a body of practical agriculturists on a variety of topics on which information was required. The organization will, it is hoped, be the nucleus of an agricultural association which will in reality, and not in name merely, be of service to Government. The same gentlemen are now sending me forecasts of the cotton and til crops and will continue their reports on the wheat crop, with the addition of linseed, as before.

65. *Departmental (Agricultural) Journal.*—With the sanction of Government a vernacular journal was started towards the end of the year under report. The object was to endeavour to diffuse information on agricultural matters among those—including nearly the entire agricultural population—to whom hitherto such information has been inaccessible by reason of its being in the English language. Extracts from the Proceedings of the Department, from Agricultural Journals of India, England, and America, results of experiments, descriptions and advertisement of implements, all find a place in it. It is issued monthly. Each number contains, in addition to the information given, a brief editorial discussing some important agricultural questions. All that is demanded from subscribers in the provinces is postage in advance. The monthly issue is 350, and the journal is gradually becoming popular. The whole work connected with it, including printing and paper, costs only Rs. 40 per month. When, however, the monthly issues come to be increased, we shall have to spend the whole of the grant, which is Rs. 70 per mensem. Subscribers in other provinces are coming forward. They, however, have to pay an annual subscription at the rate of Rs. 1-6-0 per copy, including postage.

66. *Indo-Colonial Exhibition.*—The work connected with this exhibition has, I am bound to report, somewhat crippled us during the year in other and more important business. Colonel Pitcher has had entire charge of details, in addition to his ordinary duties, and has found the burden a heavy one.

In organizing the collections for the Calcutta Exhibition, the plan was adopted, under suggestions from the Government of India, of accepting such exhibits as art-workmen or their masters might be ready to send on the offchance of sale, purchasing only where contributions of such a nature were unobtainable.

In practice however the plan was found to have serious disadvantages, and on this occasion sanction has been given to the purchase of all exhibits required, and a grant of Rs. 2[illegible],000 allotted to meet all expenses falling on the provinces. In addition, a grant of Rs. 2,600 was made by the Royal Commission in England for the purpose of building a façade of a total length of 190 feet and 10 feet 6 inches high, to be constructed in carved wood or stone, characteristics of the bazar art of these provinces. Work for the façade is being carried out at Saháranpur, Cawnpore, Lucknow, Agra, Muttra, and Farukhabad.

In view of securing the highest class of work, a scheme was submitted to and approved by the Local Government for offering prizes for the best specimens of art-ware at each art centre, to be awarded in November, 1886. Meantime the Deputy Commissioner of Lucknow, Colonel Hastings, before the close of the year, brought forward a proposal for an Art Exhibition at Lucknow, with which it was finally concluded to amalgamate departmental operations in regard to awarding prizes and selecting purchases for London.

A notice of the Lucknow Exhibition must be reserved for the following year; but it may be mentioned that to exhibitors generally the results appear to have been eminently satisfactory, and considerable impetus has undoubtedly been imparted by it to enquiries for and about the art-ware of the provinces.

It was in the beginning arranged that the Department should have to do with the art-ware collections only; but, commencing with the addition of building the façade, work has expanded into making collections of rough manufactures, of

commercial samples of produce, agricultural implements, ethnological collections, geological and mineral collections, and finally taking charge of and ticketing, packing, &c., collections from all other departments of the province.

MUSEUM.

67. During the year, the re-organization of the Lucknow Museum has received earnest attention from the committee. A Curator has been appointed, under whose care the collections, especially those of coins and antiquities, have been arranged in a systematic and scientific manner. The ornithological collection has been greatly enriched by contributions from the collections of Mr. Allen Hume and from Southern India, and by the collection generously donated by Mr. George Reid of Lucknow. Mr. Reid has further undertaken the labour of classifiying and cataloguing what is now a very fine collection. In the section of fine arts, the weeding out of faded samples and the purchase of fresh collections is proceeding, and the occasion of the Lucknow Exhibition has offered an opportunity of securing good examples. In addition to the Lal Baradari, to which fine building the Museum was transferred in the previous year, the adjoining building, known as the Farhat Baksh, has been added and plans for connecting the two buildings by an overbridge are under the consideration of the committee. Meantime the Farhat Baksh is being adapted to its ultimate purpose, that of containing the herbarium, geological and mineral collections, and library.

GENERAL.

68. I took over charge of this Department on the 12th August; so that my charge virtually commenced with the beginning of the year under report.

Colonel Pitcher has been Assistant Director for Oudh during the whole year, and, in addition to his special Oudh branch, shared with me for part of the year some of the heavier work in the North-Western Provinces.

Mir Muhammad Husain was appointed to the Department in February, 1885, and has done good service both in the Farm branch, of which he has charge, and in a limited amount of district work too.

There was no European Assistant Director for the North-Western Provinces, nor was there an Engineer attached to the Department during the year. Mr. Copeland is on probation as Assistant Engineer for Court of Wards' estates. Pandit Ajudhia Parshad has been appointed Honorary Assistant Director of Agriculture.

Mr. W. A. McLaughlin, Personal Assistant, was dismissed in August last for very serious delinquencies. Babu Lachhman Parshad was appointed in his place. An abstract of the total expenditure of the year under all heads is appended to this report.

The correspondence transacted by the Department may be measured by the fact that the receipts and issues of letters amount to a total of 24,716.

I have the honor to be,

SIR,

Your most obedient servant,

DONALD SMEATON,

Director

APPENDIX I.

Note on the "Rabi and Kharif Crops," by PANDIT AJUDHIA PARSHAD, *Honorary Assistant Director of Agriculture and Commerce.*

THE acclimatized seed raised during the past years from the Kashipur and Jaunpur maizes was tried at Indalpur. The seed was scattered very thinly, and when it had germinated some *sorahea urd* was sown in the same plot as a subordinate crop. I was tempted to do so by the bad result which these maizes gave me in the previous years, so that in case they failed again, the *urd* crop would recoup me for the expenses entailed by the cultivation of the former. The *urd* crop was extraordinarily luxuriant, while the maizes too yielded a tolerably fair outturn.

Sorghum.—The success that I met with last year in making sugar from sorghum-juice had stimulated the cultivators here to try sorghum, and when the time for sowing it came, the *asamis* applied to me for seed. I issued seed accordingly to 26 persons in 11 different villages. It was tried by them on land amounting in the aggregate to more than 7 acres. I myself tried it on about 7 acres, hoping to have an opportunity of conducting an experiment on a large scale. I had bargained with those *asamis* to whom I had issued seed for the purchase of their sorghum stalks when ready just as I bargain for sugarcane, and I intended to make *ráb* from sorghum on a large scale. But when the crop was nearly ready some severe showers of rain fell and all the stalks almost were spoilt. A reddish rust was generated within them, which destroyed the juice and deteriorated the stalks. The result was that on pressing the juice the *ráb* made was entirely worthless. I am not at all disheartened by this failure, as I attribute it to accident alone, and next season I am determined to give sorghum a very fair trial again, so as to be able to determine its commercial value.

Soft white wheat.—I tried this variety of wheat extensively as usual, and I am glad to state that my opinion as to the adaptability and utility of its cultivation here is gaining strength year by year. I find that it yields a better outturn than the *kathia* wheat. I am glad to state that my opinion is corroborated by a gentleman named Muhammad Akbar Khan, a zamíndár in this district, who takes a great deal of interest in agricultural experiments and had tried about 3 bighas of this wheat. The subjoined translation of an extract from the result that he reported to me will show what he thinks of this wheat. Before quoting him I must premise that he thinks that the circumstances under which he conducted the experiment were very unfavourable. Firstly, he could not, owing to the late rains, reduce the moisture in the field, as a consequence of which mildew and blight attacked the crop and deteriorated it materially. Secondly, owing to unvoidable causes the sowing was very late. Nevertheless the gentleman says :—"I therefore conclude with the opinion that this variety of wheat is capable of yielding better outturns if properly attended to than the ordinary varieties cultivated here. It must be borne in mind that the ordinary wheat is sown at the rate of *seven* seers to the *bigha kham*, whereas I sowed the soft white variety at the rate of two seers per *bigha* less, and even then I find that its outturn is much better."

Múdea, or soft white beardless wheat.—I tried this variety extensively. This year it was attacked by mildew and blight and the entire crop almost was a failure. As in the previous trials it stood the test successfully. I am disposed to consider this failure as abnormal. I believe I will be able to state my opinion about this variety definitely after a few further trials.

Winter maizes.—I tried some of these maizes with seed that I had acclimatized and hybridized here during the past seasons. At the outset I must remark a peculiarity

which I have observed with regard to this seed during the trials I gave it for the last five years. I find that imported seed when it comes to this country invariably deteriorates at the first trial and yields grain not at all to be compared with the original. But when the acclimatized though inferior seed is tried over again, the produce gradually improves until grain of considerable excellence is produced.

I am disposed to think that the winter maizes will never do well as field crops: they require too much attention and care to be able to bear the comparatively rough treatment which a field crop undergoes. To gentlemen this variety offers great inducement for trial as a garden crop, and the *káchhás*, who raise crops for the kitchen mostly, will find a ready market for the green cobs.

The unusual season, too, in which the winter maizes ripen will also render them very marketable in cities. I have been in the year under report successful in inducing some gentlemen to try these maizes. Muhammad Akbar Khan, whose report has been mentioned above, tried them and was successful. Pandit Parmeshwari Das, a pleader at Bara Banki, tried these maizes and was very successful. He sent some cobs to the Nauchandi exhibition at Meerut, where, I believe, you saw them. His report, which I enclose herewith, gives the details of the experiment.

I personally tried these maizes and had the usual success with them.

Flax, linseed.—Some seed of this variety of linseed was received through your Department. I tried it on a small scale, and the result is that I have got enough of seed for the next year's trial. Any further remarks about it would be rather premature at present.

Rasuli barley.—I received some seed from your Department and tried it here. The crop flourished well, and I have obtained a sufficiency of seed for next year.

Mildew and blight.—The wheat crops last season suffered very severely from mildew and blight. Originally the crops, both irrigated and unirrigated, were very flourishing, but about the middle of January signs of blight became apparent. On the night of the 6th of February a slight shower fell here, and the next morning the condition of the fields looked better. A slight amelioration in the crops was witnessed thenceforward—a fact which leads me to the conclusion that the shower washed the plants clear of the fungi which constitute mildew and blight.

I noticed also that mildew and blight do not affect the irrigated fields so much as the unirrigated ones. This also holds good, as far as my observation extends, with barley. The barley fields in the beginning were as healthy and promising as could be, but all of a sudden about the end of February, 1885, mildew attacked some fields of unirrigated barley. The disease then commenced to spread until it embraced all the unirrigated barley fields. The Indian cultivators assign the evils of mildew and blight to an excess of moisture in the field, as well as to the influence of excessive rain or frost or continuous cloudy weather. I can testify to the truth of part of this statement, as I found lowlying and consequently moist fields were more affected by the disease than upland ones. Muhammad Akbar in his report on the soft white wheat also attributes this disease to excess of moisture. Summing up the several observations that I have made, I could safely assert that it would go a great way towards protecting crops from mildew and blight were fields ploughed deep and manured and irrigated. I noticed that a barley field of mine which had been ploughed twice with English plough withstood all attack of the disease and remained healthy. There is an agricultural proverb current among the ryots here: "*Sabai kisnae hethe Aghanea páne jéthi,*" which means that all cultivation is backward, but that which is watered in the month of *Aghan* is superior. I noticed the remarkable truth of this maxim, inasmuch as I found that fields that had been watered in *Aghan* were quite free from mildew and blight. There is another proverb current of a similar signification: it runs thus: "*Aghan men sarba bhar phir karba bhar*"—meaning that a bowl of water in *Aghan* does much good (or more) than a whole *karba* (pitcher) applied subsequently.

Cattle-disease.—I met with very severe loss last year in my herd of buffaloes. About 32 of them died in a few days of a disease which the natives term *rij*. The *salutri* that was sent here by your Department some years ago named this disease cattle-pox. I took all the precautions I could, but without effect. Only one or two buffaloes survived out of the whole herd. The disease distroyed cows and bullocks too. In this as well as the neighbouring villages the losses sustained by the ryots were enormous. I would take advantage of this occasion of making a suggestion about which I have been thinking for some time past. In every city the district boards spend large amount of money on roads, hospitals, and other public works. Would it not be well were a suggestion made to them to spend a small portion in maintaining at the head-quarters of each district a *salutri*, who could make the tour of the district and treat cattle wherever occasion should require. I hope I shall be excused for the boldness of making this suggestion; but I am inclined to think that you would approve of it, as it is calculated to render very material help to the ryots—a class of people who, above all, deserve, owing to the peculiarity of their circumstances, the greatest encouragement.

Implements.—With regard to the *Duplex* ploughs, about which I promised my remarks last year, I beg to state that the cast-iron Duplex does not make a furrow wide enough for sowing sugarcane. During my last visit to the Cawnpore Agricultural Station I saw a Duplex plough that had been lately improved there. I found that the difficulty of which I complain in the original plough has been obviated in the improved one, which will fit it both for a ploughing as well as sowing implement.

APPENDIX II.

Memorandum by PARMESHARI DAS *on the cultivation of Winter Maizes in the Bara Banki district.*

Seed.—The seed was received from you.

Sowing.—The sowing was compulsorily delayed owing to the heavy *Hathia* rains this season: it was actually effected in *Pús* 1292 fasli or November, 1884. I am sorry I have not been keeping a diary as I should have done, and am unable, therefore, to give the exact date of sowing. It was not done in drills, but was broadcast, after the native method almost universally obtaining in the country. The result teaches that the broadcast mode of sowing was a mistake, particularly when the experiment in question was intended to be a gardening measure. Moreover, the drill system is lengthy and expensive, and will seldom be resorted to unless you suggest something to bring about acceleration and consequential reduction in costs.

Soil.—The soil used was not rich, nor had it been well tilled and ploughed.

Watering.—There were hardly any winter rains this year sufficient to dispense with the necessity of artificial irrigation, and the watering therefore was more than ordinary.

Cobs.—The average number of cobs per plant was four. The maximum height of the plants was 12 feet. The cobs were partly ripe in the early part of March, 1885. The process of ripening was gradual and extended over more than a month. The colour has varied from whitish brown to deep golden.

Result.—Mr. J. White, Deputy Commissioner of the district, to whom I have had the honour of making a present of seven cobs in number, has pronounced the experiment fairly successful. I sent some eight cobs to you while you were at Meerut on or about the 21st March last, and you are in a position in more than one way to have formed your own opinion as to the result of the experiment. My own view is that the experiment, as a whole, has not been a failure, but a fair success. The shortcomings are due to want of experience.

I am by profession a *vakil* as you know, and have, as such, occasion to come in contact with the people of the agricultural class. They appreciate and admire the

cobs, and many of them have requested me to give them some ripe cobs for seed, to enable them to sow it in their fields the next winter.

Wheat.—The *murria* or soft white wheat has also been a success, and to give in details the particulars connected with this experiment would be an intrusion upon your time so valuably employed, as the experiment in question was tried on so small a scale as scarcely to be appreciable. The smallness of scale is due to smallness of land in my possession.

APPENDIX III.

Memorandum showing total expenditure and receipts of the Department of Agriculture and Commerce, North-Western Provinces and Oudh, for 1884-85.

Heads of charges.	Budget expenses.	Budget receipts	Actual expenses.	Actual receipts.	Net expenses.	Savings on budget grant.
	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p	Rs a. p.	Rs. a. p.
Office establishment ...	24,084 0 0	...	23,443 14 3	...	23,443 14 3	640 1 9
Office contingencies ...	*10,916 0 0	...	10,795 13 5	...	10,795 13 5	120 2 7
Office travelling allowance.	3,000 0 0	...	2,993 0 0	...	2,993 0 0	6 15 6
Oudh office establishment.	2,568 0 0	...	2,199 0 0	...	2,199 0 0	369 0 0
Gházipur tobacco farm,	4,200 0 0	6,500 0 0	4,203 4 2	9,750 0 0	5,546 11 10 (net receipt).	3 4 2 (excess).
Reh and glass experiment contingencies.	2,874 0 0	...	1,525 8 6	577 7 6	948 1 0	1,348 7 6
Reh and glass experiment establishment.	2,376 0 0	...	2,865 11 2	...	2,865 11 2	489 11 2 (excess).
Traffic registration ...	10,000 0 0	...	7,486 4 7	...	7,486 4 7	2,513 11 5
Cawnpore experimental farm contingencies.	9,634 0 0	4,000 0 0	7,542 15 1	2,092 10 6	5,450 4 7	2,091 0 11
Cawnpore establishment.	4,858 0 0	...	†5,466 0 0	...	5,466 0 0	608 0 0 (excess).
Cawnpore workshop ...	7,000 0 0	5,000 0 0	4,640 5 8	2,040 8 6	2,599 13 2	2,359 10 4
North Indian manufactures.	5,000 0 0	5,000 0 0	...	470 9 6	470 9 6 (net receipt).	5,000 0 0
Bull fund imprest ...	‡1,330 15 4	1,330 15 4	232 10 6	3,183 0 4	2,950 5 10 (net receipt)	1,098 4 10
Seed imprest ...	2,000 0 0	2,000 0 0	343 7 3	769 1 6	425 10 3 (net receipt).	1,656 8 9
Well Fund ...	§4,000 0 0	...	2,766 3 0	...	2,766 3 0	1,233 13 0
Total ...	93,840 15 4	23,830 15 4	76,504 2 1	18,883 5 10	57,620 12 3	17,336 13 3

* Includes Rs. 1,000 transferred from Well Fund and Rs. 2,000 from the general savings of the budget.

† The excess expenditure represents the horse allowance drawn by the Superintendent of Experimental Farm.

‡ Less Rs. 669-0-8 written off the imprest during previous year.

§ Less Rs. 1,000 transferred to office contingencies.

ORDERS OF GOVERNMENT.

No. $\frac{147}{1-218}$ OF 1886.

FROM

THE CHIEF SECRETARY TO GOVERNMENT,
N.-W. PROVINCES AND OUDH,

TO

THE DIRECTOR OF AGRICULTURE AND COMMERCE,
N.-W. PROVINCES AND OUDH.

DATED ALLAHABAD, THE 27TH JANUARY, 1886

SIR,

REVENUE DEPARTMENT.

I AM directed to acknowledge the receipt of your report on the operations of the Department of Agriculture and Commerce, North-Western Provinces and Oudh, during the year ending the 30th September, 1885, and to express His Honor's satisfaction at the punctuality with which the report has been compiled and submitted.

2. Most of the matters dealt with in this report are separately communicated for the information and orders of the Government in the detailed returns and reports submitted by you either directly or through the Board of Revenue. The present report brings all these together and supplies a comprehensive and very useful narrative of the various measures which engaged the attention of the Department during the year.

3. Deserved prominence has been given to the maintenance of village records and the collection of agricultural statistics, which must for some time continue to be the most important duty devolving on your Department. Success in this direction must be sought in the active co-operation of the district staff assisted by the supervision of the departmental officers; and the Lieutenant-Governor would again take this opportunity of asking all district officers to spare no pains and to exert themselves continuously to secure correct and punctual preparation of the village and pargana records. Besides the inspection of field and office work in nearly all the districts of the united provinces, the attention of yourself and your subordinates has been devoted to the education of kanúngos and patwáris, the better supply of blank forms and maps, and the examination of districts where a revision of the land-revenue assessment is impending. In the districts under settlement or cadastral survey the re-arrangement of patwáris' circles now approaches completion. By the introduction of the pargana book a beginning has been made of the classification of districts and portions of districts according to their resources and protection against failure of crops.

4. The formation of fodder and fuel reserves, the reclamation of úsar land, and the development of well irrigation are the chief protective measures which have formed the subject of experiment and observation. The supply to different districts of boring-tools for well-sinking, with workmen trained to use them, is a measure from which much practical advantage may be expected.

5. The agricultural experiments carried on during the year and the measures adopted to introduce agricultural improvements have in most instances already been noticed in the half-yearly reports of the Cawnpore station, and in the reports on the Government Gardens at Saháranpur and Lucknow. They seem to have been conducted in a practical and useful manner. In connection with the forecast of special crops required by the Government of India, you have created an organisation of zamíndárs and others concerned in agriculture from which you anticipate much practical advantage, both as a source of information and a means of popularising and bringing into actual use those improvements which have passed the experimental stage.

6. A very considerable amount of work not altogether germane to the original and special purposes of the Department has been imposed on its officers in connection with the Indo-Colonial Exhibition; and it is much to be desired that this should not too often recur.

7. The Lieutenant-Governor and Chief Commissioner has much pleasure in acknowledging the very zealous and energetic manner in which you, aided by Lieutenant-Colonel Pitcher, have conducted the duties of the Department. Mír Muhammad Husain (now Officiating Assistant Director) joined the Department during the year, and the Lieutenant-Governor hopes that from his training in England and the interest taken by him in agricultural matters generally, he will prove a capable and useful assistant. The services rendered by Pandit Ajudhia Parshad, Honorary Assistant Director, and the other private gentlemen who have aided you with their advice and co-operation, deserve the commendation of the Government; and I am to request you to let them know that their good will and activity in helping you are properly appreciated.

I have the honor to be,

SIR,

Your most obedient servant,

J. R. REID,

Chief Secy. to Govt., N.-W. P. and Oudh.

No. $\frac{148}{1-218}$.

COPY forwarded to all District Officers, North-Western Provinces and Oudh, for information, with special reference to paragraph 3.

By order, &c.,

T. STOKER,

Under-Secy. to Govt., N.-W. P. and Oudh.